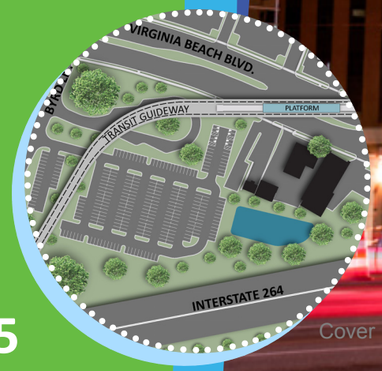
HAMPTON ROADS TRANSIT

U.S. Department of Transportation
Federal Transit Administration



Draft Environmental Impact Statement

VIRGINIA BEACH TRANSIT EXTENSION STUDY

February 2015

Cover image: courtesy of the City of Virginia Beach

Draft Environmental Impact Statement

Virginia Beach Transit Extension Study

Prepared pursuant to the National Environmental Policy Act of 1969, Section 102 (42 U.S.C. §4332); and Federal transit laws (49 U.S.C. §5323(c) and §5309; 49 U.S.C. §303 [formerly Department of Transportation Act of 1966, Section 4(f)]; National Historic Preservation Act of 1966, Section 106 (54 U.S.C. §300101 et seq.); Executive Order 11990 (Protection of Wetlands); Executive Order 11988 (Floodplain Management); Section 402 of the Clean Water Act; Executive Order 12898 (Environmental Justice); the Endangered Species Act of 1973 (16 U.S.C. §1531); the Clean Air Act (42 U.S.C. §7401); and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. §4601).

This document describes and summarizes the potential transportation and environmental effects, costs, and benefits, and presents a comparative evaluation of the alternatives.

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Abstract

The Virginia Beach Transit Extension Study examines a range of alternatives for extending high capacity fixed guideway transit service from the eastern terminus of The Tide, the City of Norfolk's light rail transit towards the Oceanfront Resort Area in Virginia Beach. The purpose of the project is to support local plans for strategic growth and improve transportation and transit system efficiency and intermodal connectivity. The Virginia Beach transit extension would connect to many major employment and activity centers and would provide an alternative to the heavy roadway congestion in and around these activity centers. The transit extension would also include a robust feeder bus system that would provide a wider local transit network.

The alternatives include the No Build alternative and eight build alternatives. The build alternatives include four using bus rapid transit (BRT) technology and four using light rail transit (LRT) technology. The project would be completed in a manner that minimizes adverse effects on the environment and maximizes benefit to the community.

Prepared by:

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Chapter 1

Chapter 2

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Chapter 1

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Chapter 4

EXECUTIVE SUMMARY

ES.0 Introduction

The Virginia Beach Transit Extension Study (VBTES) is a multi-year study evaluating the range of alternatives for extending The Tide light rail transit (LRT) east into the City of Virginia Beach. The VBTES Corridor is centered on the former Norfolk Southern railroad right-of-way (NSRR ROW) and generally parallels I-264 (See **Figure ES.0-1**). This draft environmental impact statement provides a comparative analysis of the benefits and impacts of the alternatives being considered in the VBTES.

This draft environmental impact statement (DEIS) fulfills the requirements outlined in the National Environmental Policy Act of 1969 (NEPA). The DEIS describes the transportation alternatives being considered and evaluates the full range of project related impacts to the built and natural environments. Potential mitigation strategies were also identified to address impacts resulting from the build alternatives.

Generally, the No Build alternative would not adversely impact existing conditions in the VBTES Corridor and mitigation measures would not be required. The level of impacts associated with the build alternatives were analyzed for a variety of existing conditions in the VBTES Corridor and fall under three broad categories: transportation, social effects, and environmental effects. The full range of impacts and mitigation strategies are discussed throughout this document.

Another important element of the DEIS process is ongoing engagement with community members and stakeholders through public forums and meetings. Outreach efforts also involved coordination with local, state, and federal resource agencies.

ES.1 Purpose and Need for the Project **(Chapter 1)**

The primary purpose of providing a fixed guideway transit extension in the VBTES Corridor is to:

- Support the City of Virginia Beach's plans to limit suburban-style growth and development.
- Improve transportation and transit system efficiency and intermodal connectivity.

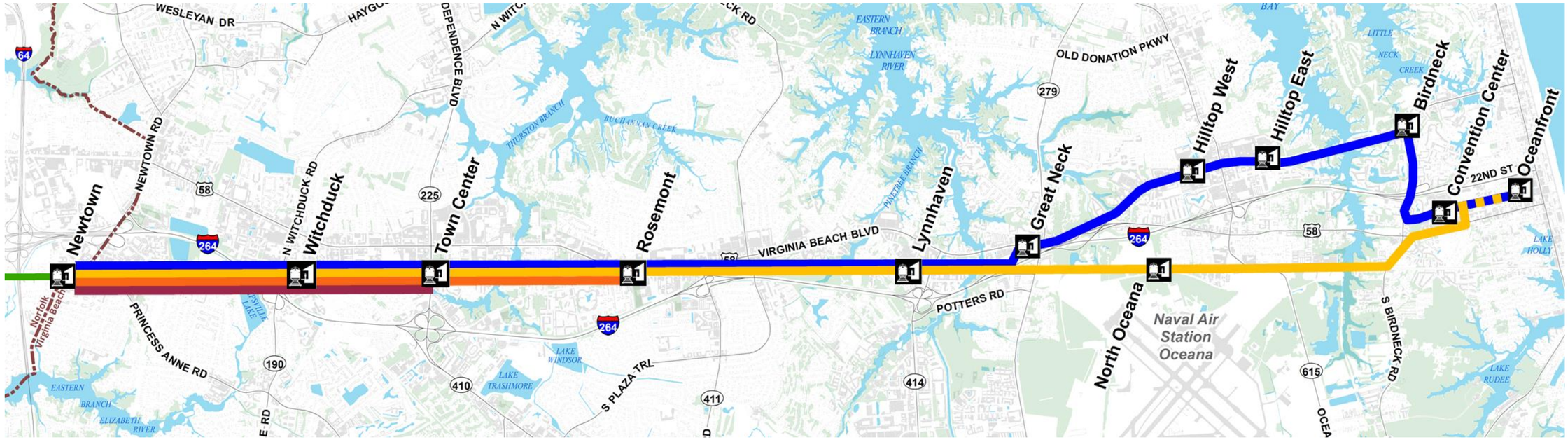
The Virginia Beach transit extension is needed to address the following transportation challenges in the VBTES Corridor:

- East-west mobility is limited to a few congested roadways.
- The lack of mobility choices in the VBTES Corridor is impacting the largest economic engines in the City.
- Transit service in the VBTES Corridor is impacted by congestion levels causing it to be slow and unreliable.

ES.2 Project Alternatives **(Chapter 2)**

The VBTES considered transit alignments and modes that meet the purpose and need of the project as well as a baseline No Build alternative. Four alignment alternatives

Figure ES.0-1 | The VBTES Build Alternatives and Proposed Station Locations



Source: HDR, 2014

Legend:

- Alternative 1A (Town Center)
- Alternative 1B (Rosemont)
- Alternative 2 (NSRR)
- Alternative 3 (Hilltop)
- Common Segment (Alternatives 2 & 3)
- Proposed Station Locations
- Norfolk LRT "The Tide"

were studied, each with two different transit modes (LRT and bus rapid transit, or BRT) for a total of eight build alternatives. The build alternatives are described below and in greater detail in **Section 2.1.1**.

- **Alternative 1A: Newtown Road to the proposed Town Center Station (Town Center Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW to a new station in the vicinity of the Town Center of Virginia Beach (approximately 3 miles).
- **Alternative 1B: Newtown Road Station to the proposed Rosemont Station (Rosemont Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW to a new station near Rosemont Road (approximately 4.8 miles).
- **Alternative 2: Newtown Road Station to the proposed Oceanfront Station via the NSRR ROW (NSRR Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east to a proposed station in the Oceanfront Resort Area largely following the former NSRR ROW and including segments along Birdneck Road, 17th Street, Washington Avenue, and 19th Street (approximately 12.2 miles).
- **Alternative 3: Newtown Road to the proposed Oceanfront Station via Laskin Road (Hilltop Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW and then through the Hilltop SGA on Laskin Road to a new station in the Oceanfront Resort Area via Birdneck Road and 19th Street (approximately 13.5 miles).

Tables ES.2-1A and B contain a summary of the LRT and BRT project alternatives, including capital costs, operations and maintenance costs, and forecasted ridership.

The No Build alternative is described in **Section 2.2**. It consists of the existing highway network and transit services and facilities, as well as proposed highway and transit facilities that have been included in the Hampton Roads Transportation Planning Organization's 2034 financially-constrained *Long-Range Transportation Plan.*

Station locations for the alignment alternatives under consideration are shown in **Figure ES.0-1** and listed in **Tables ES.2-1A and B**. Each station would be accessible by pedestrians, bicycles, buses, and cars, and most stations would have Park & Ride lots. New stations for light rail or bus rapid transit would have passenger amenities similar to what is currently found on The Tide. Additional detail about the station locations can be found in **Section 2.1.2**.

ES.3 Transportation **(Chapter 3)**

Transportation impacts were assessed by how the build alternatives would affect transportation conditions in the VBTES Corridor. These impacts include how the No Build and build alternatives would alter the roadway and transit network in the VBTES Corridor and identify potential impacts to parking facilities and bicycle and pedestrian facilities. See **Table ES.3-1** for a summary of transportation impacts.

Streets and Highway Network (*Section 3.1*)

Currently, the roadway and highway network in the VBTES Corridor experiences elevated traffic volumes during the morning and afternoon peak travel periods, and traffic conditions are expected to worsen in the future. The build alternatives would increase congestion in the study area at specific intersections, while other intersections would see an increase in congestion due to expected traffic volume growth regardless of any of the build alternatives. While the build alternatives would increase the transit options available by providing an additional mode of transportation, the build alternatives would not be expected to directly decrease congestion on area roadways from current levels. However, the build alternatives would support citywide and regional transportation goals by improving transit connectivity in the City of Virginia Beach and Hampton Roads, providing mobility options, and potentially decreasing the rate of increase in congestion.

There are elevated crossings of major roadways in all build alternatives, which are listed in **Table ES.3-1** and discussed in **Section 3.1.5**. Installation of bridges at these crossings would require partial or complete closures of the roadways while they are being constructed.

Transit Network (*Section 3.2*)

Hampton Roads Transit (HRT) provides public transportation for the City of Virginia Beach and five other localities in Hampton Roads. Currently, HRT operates a variety of bus routes in the City, including fixed routes, express routes, and seasonal routes.

Under the build alternatives, changes would be made to the current bus route network to serve the proposed transit stations and to improve overall transit connections to the places people live, work, and play. Bus service hours would increase to match the span of service for LRT or BRT operations. Among the build alternatives, Alternative 3 for both LRT and BRT would generate the largest increase in transit riders overall. Details can be found in Chapter 3 and further details in Appendix K.

Parking Facilities (*Section 3.3*)

The build alternatives would offer new parking in the VBTES Corridor with Park & Ride lots located near most of the proposed transit stations. The proposed number of spaces was determined from the area of the sites that have been identified for parking, while projected parking demand was based on the forecasted ridership that would arrive at stations by driving. The projected demand could be accommodated by the proposed number of spaces at all of the identified Park & Ride lots except the Town Center station under LRT Alternative 1A and the Rosemont station under LRT Alternative 1B.

Under the LRT Alternative 3, Birdneck Road would need to be widened, which would impact three private parking lots and would remove 18 parking spaces. Birdneck Road would not need to be widened under BRT Alternative 3 and impacts to private lots would not occur. All of the build alternatives would temporarily affect parking access and availability at some properties during the construction phase. The City, HRT, and affected property owners would work together to develop and implement a mitigation plan that would reduce disruptions associated with LRT construction.

Bicycle and Pedestrian Facilities (*Section 3.4*)

Improvements to bicycle and pedestrian facilities associated with the build alternatives would include enhancing connectivity between proposed transit stations and the existing sidewalk network. Additionally, the City of Virginia Beach adopted a *Bikeways and Trails Plan* in 2011 that focuses on enhancing the network of bicycle and pedestrian pathways throughout the VBTES Corridor and citywide. The City of Virginia Beach has begun a study to examine the feasibility of constructing a parallel shared-use path within the former NSRR ROW, which had been identified as a priority in the *Bikeways and Trails Plan*.

Construction impacts related to the build alternatives would be temporary. The primary impacts would be to existing sidewalks, which would be closed for safety reasons at identified areas during the construction phase. Associated mitigation measures would include safety improvements at intersections where the build alternatives would cross roadways in the VBTES Corridor. **Section 4.7** further details safety and security measures for the build alternatives in this study, including pedestrian and bicycle safety.

ES.4 Social Effects **(Chapter 4)**

The analysis performed for social effects evaluated characteristics of the built environment of the VBTES Corridor and considered the direct, indirect, and combined effects the No Build and build alternatives would have on individuals living and travelling in the VBTES Corridor. Land use, visual quality, and safety and security are among the conditions assessed in Chapter 4. See **Table ES.4-1** for a summary of social effects impacts.

Land Use (*Section 4.1*)

Impacts to land use within the VBTES Corridor are not directly anticipated from the build alternatives. The VBTES Corridor is a developed travel thoroughfare with a mix of land uses throughout. Residential areas are found primarily to the north and south, and a blend of commercial and industrial uses occur along the main arterials within the

VBTES Corridor. Indirect and combined changes to land use from any of the build alternatives would be consistent with adopted planning and policy documents which support the implementation of fixed guideway, high capacity transit in the City's Strategic Growth Areas.

Economic Development (*Section 4.2*)

The build alternatives are not expected to directly create development within the VBTES Corridor. The build alternatives would have indirect impacts by supporting future economic development within the City's SGAs and proposed station areas. High capacity, fixed guideway transit has been cited in many City of Virginia Beach planning documents as an important component to future growth in the VBTES Corridor. The tax revenue lost from acquiring private commercial properties for the build alternatives would have a minor impact on the local tax base. However, the build alternatives would not have long term adverse impacts to the citywide economy.

Acquisitions and Displacements (*Section 4.3*)

The build alternatives would require various acquisitions and/or displacements for the different alternatives and technologies. Acquisitions and/or displacements would be required in some areas to accommodate various system components, including the proposed station sites, Park & Ride lots, roadway widening, and turn lanes. Where the build alternatives are elevated above major intersections, bridge structures would need to be constructed and adjacent properties would be affected. Required land acquisition along the build alternatives has been minimized by using City-owned property in the VBTES Corridor whenever possible. Property acquisitions and displacements would be coordinated with the City and property owners.

Cultural Resources (*Section 4.4*)

A reconnaissance-level survey of cultural resources has been prepared for the DEIS, which began to identify historic properties in the VBTES Area of Potential Effect (APE) and develop an historical context for the corridor. There are 516 historic-age (pre-1971) resources in the APE, and three of these have been identified as listed or eligible for listing in the National Register of Historic Places. A detailed analysis of the impacts to cultural resources has not been performed for the DEIS. Additional analysis on the location-specific potential impacts would be assessed in the final environmental impact statement (FEIS).

Parklands and Recreation Areas (*Section 4.5*)

Eight parkland and recreation areas were identified adjacent to the build alternatives. Alternative 3 may have a minor impact on one privately-owned golf course. Potential impacts and mitigation measures would be discussed with property owners prior to construction and operation. The implementation of these measures would minimize any effects to parklands and recreation areas. The build alternatives would provide improved transit connections and accessibility to parklands and recreation areas along the VBTES Corridor.

Visual Quality (*Section 4.6*)

The VBTES Corridor runs through substantially developed areas of Virginia Beach, and visual quality impacts associated with the build alternatives would not substantially alter the physical landscape. Where the build alternatives would operate within the former NSRR ROW, existing vegetation would minimize effects to visual quality. Depending on the alternative and technology selected, new elements would be introduced to the VBTES Corridor, including an overhead contact system (OCS) for LRT operations or new buses for BRT operations. Mitigation efforts would be incorporated into the design of a future transit extension and coordinated with the needs of local communities.

Safety and Security (*Section 4.7*)

HRT would develop a Safety and Security Management Plan to identify activities that must be performed and documented related to safety and security throughout all phases of the project's development. The build alternatives would incorporate various safety measures to support transit operations and reduce the potential for accidents. Among the safety elements that would be introduced are signalized and gated crossings, marked crosswalks, emergency call boxes, protective fencing, and station security cameras. Safety improvements that would address location-specific concerns would be further developed as the project's design advances.

Community Facilities (*Section 4.8*)

Community facilities in the VBTES Corridor could experience temporary changes to access as the selected build alternative is constructed. Construction-related impacts would primarily affect community facilities on the Laskin Road section of Alternative 3. Mitigation strategies would be established in coordination with property owners to minimize any adverse construction related impacts.

ES.5 Environmental Effects (Chapter 5)

The DEIS evaluated the range of potential impacts that the No Build and build alternatives could have on the natural environment within the VBTES Corridor. The primary purpose of this section is to provide an understanding of the effects to environmental conditions in the VBTES Corridor that could be anticipated and the mitigation measures that could be undertaken to minimize the potential impacts. See **Table ES.5-1** for a summary of environmental effects impacts.

Soils and Farmland (*Section 5.1*)

The VBTES Corridor is an urbanized area with existing development throughout. As such, the build alternatives would have minor effects on soils and farmland. The primary impact to soils in the VBTES Corridor would be related to grading during the construction phase; however, the impacts would be minimal, and mitigation measures that would address erosion control would be further developed during subsequent study phases following local, state, and federal regulations.

There are no protected prime farmlands in the VBTES Corridor. There are two areas being actively farmed in the vicinity of NAS Oceana. Areas of active and potentially active farmland would require drainage upgrades. However, most of the VBTES Corridor has an existing urban character that is not supportive of expanding farmland areas. Due to the current development pattern of the VBTES Corridor, no mitigation measures are planned, as no impacts to farmland are anticipated.

Surface Water and Water Quality (*Section 5.2*)

The build alternatives would affect surface water and water quality in the VBTES Corridor where localized areas of increased stormwater runoff would occur. These areas include the wider guideway, maintenance roads, proposed stations, and Park & Ride lots, where the quantity of impervious surfaces might increase. However, the VBTES Corridor is developed and the build alternatives would not substantially alter impervious surface cover.

The increase in surface runoff and potential effect on water quality would be addressed through the stormwater management plan that will be developed later in the project's design. This plan will include measures to control water quality and quantity in accordance with local, state, and federal regulations.

Wetlands (*Section 5.3*)

Construction of the build alternatives would affect identified wetland areas near the alignment options. The quantity of potentially affected wetlands ranges from 3.58 acres for Alternative 1A to 10.49 acres for Alternative 2. Additional temporary impacts would also be expected during construction. Mitigation efforts would be undertaken to limit disturbances to wetlands within the VBTES Corridor. In coordination with federal, state, and local resource agencies, an approach would be developed that would outline how impacts to wetlands would be addressed and include the mitigation measures that would be applied. Potential impacts to wetlands in the VBTES Corridor would be further evaluated in the FEIS.

Floodplains (*Section 5.4*)

The potential impacts to floodplains attributed to the build alternatives would range from 0.2 acres for Alternative 1A to 9.3 acres for Alternative 3. The build alternatives are not expected to have long-range impacts on floodplains in the VBTES Corridor, and there may be beneficial impacts by removing fill areas in the floodplains at the Thalia Creek and London Bridge Creek crossings. The full range of construction-related activities that would affect floodplains in the VBTES Corridor would be determined during the advanced design stages of the project. Permitting that would approve the construction and operation of a build

alternative within floodplain areas would be coordinated with applicable resource agencies.

Navigable Waterways (*Section 5.5*)

Within the VBTES Corridor, three navigable waterways were identified that could potentially be impacted by the build alternatives: Thalia Creek, London Bridge Creek, and Upper Linkhorn Bay. All of these are within the Lynnhaven River watershed. Among the build alternatives, Alternative 1A would not cross any navigable waterways. Alternative 1B would cross Thalia Creek, Alternative 2 would cross Thalia Creek and London Bridge Creek, and Alternative 3 would cross all three of the navigable waterways in the VBTES Corridor. Mitigation efforts focused on limiting construction impacts and addressing safety concerns, such as the temporary closing of waterways during construction, would be further refined in the FEIS.

Habitat and Wildlife (*Section 5.6*)

The VBTES Corridor is substantially developed with a variety of land uses. As such, the build alternatives would have minor impacts to natural habitats. Regarding wildlife in the VBTES Corridor, assessments conducted in 2009 and 2013 concluded that no federally recognized rare, threatened, or endangered species were present in the VBTES Corridor. Protected species under the Migratory Bird Treaty Act are found to occur in the VBTES Corridor; however, these species are common, and no long-term impacts are anticipated.

Further evaluations determined that wildlife species included in state sponsored threatened or endangered species lists would not be affected by the any of the build alternatives. Construction impacts would be minimal and would be managed in coordination with applicable resource agencies. Long-term effects to the natural habitats and wildlife in the VBTES Corridor that would result from the build alternatives are not anticipated.

Air Quality (*Section 5.7*)

A qualitative air quality analysis was conducted for the VBTES Corridor due to the region's status as in attainment for carbon monoxide and particulate matter and the low potential for Mobile Source Air Toxics effects. The analysis found that the build alternatives would not create adverse impacts to air quality in the VBTES Corridor. Construction-related impacts to air quality, such as emissions from construction vehicles, would be mitigated through best management practices.

Noise and Vibration (*Section 5.8*)

A screening-level noise analysis was conducted following FTA's noise analysis methodology, which compares projected noise levels with existing noise levels and identifies potential impacts based on the land use of the noise receiver site. This analysis found potential moderate and severe noise impacts for all LRT alternatives, moderate impacts for BRT alternatives, and no impacts projected along the feeder bus routes. Warning devices such as horns and bells at crossings contribute the most to potential noise impacts, as does the sound of the vehicle itself.

The FTA methodology was used to identify potential ground-borne vibration impacts. The criteria used for the vibration screening analysis included distance from the alignment, land use, and expected frequency of vibration events. Potential vibration impacts were found for all LRT alternatives, the locations of which were all west of London Bridge Creek. No vibration impacts were predicted for BRT alternatives of along the new feeder bus routes.

Construction activities are expected to produce short-term noise and vibration impacts. A more detailed noise and vibration analysis will be performed as part of the FEIS, and mitigation measures would be developed during future phases of design to address the source of noise and vibration impacts.

Hazardous Materials (*Section 5.9*)

A Phase I Environmental Site Assessment was performed in 2009, which identified properties along the former NSRR ROW with Recognized Environmental Conditions (RECs), such as former gas stations or storage tanks. Based on the findings of the Phase I report, a Phase II Soil and Groundwater Sampling was performed. This analysis found four soil samples and zero groundwater samples that were above the detection limits. In 2013, an EDR database report indicated 93 properties mapped as hazardous materials sites within or adjacent to the VBTES Corridor, mostly from petroleum or auto-related contamination. Some of these sites have been listed as closed cases where mitigation or cleanup has taken place.

It is not anticipated that normal day-to-day operation of either the LRT or BRT under any of the proposed build alternatives would release new hazardous materials to the environment. However, in the event of an accident, there could potentially be a release of new hazardous materials along the alignment or at the VSMF. HRT incorporates hazardous materials safety practices and protocols to prevent such releases, following all applicable local, state, and federal regulations. Therefore, impacts resulting from the operation of the LRT or BRT are unlikely.

Energy (*Section 5.10*)

The build alternatives would have the potential to reduce future energy consumption. However, the expected impact of the build alternatives would be minimal and not greatly affect long term rates of energy consumption citywide. Construction activity associated with the build alternatives would generate minor increases in energy consumption attributable to the operation of heavy machinery and equipment. Mitigation efforts would be developed to conserve energy during the construction process should one of the build alternatives be selected.

ES.6 Environmental Justice **(Chapter 6)**

An analysis focusing on the build alternatives' impacts to low-income and minority populations (environmental justice populations) determined that the build alternatives would not disproportionately impact these populations in the VBTES Corridor. Rather, the build alternatives would improve transit reliability and accessibility for environmental justice communities, residents throughout the VBTES Corridor, and citywide.

ES.7 Section 4(f) Involvement **(Chapter 7)**

Five publicly-owned parks were identified within or adjacent to the VBTES Corridor that would be subject to Section 4(f) requirements, as shown in Section 4.5. None of these public parks will be impacted by the build alternatives.

There are three historic resources that are either listed in the National Register of Historic Places or have been determined eligible for listing and are thus subject to Section 4(f).

The determination of impacts to historic resources related to the build alternatives has not been completed for this DEIS. Potentially affected historic resources would be further evaluated during the FEIS study phase.

ES.8 Public Involvement/Agency Coordination **(Chapter 8)**

Public involvement and agency coordination activities have occurred throughout the duration of the VBTES. During the early stages of the VBTES, coordination plans were developed that established a comprehensive framework for public involvement and agency coordination. These plans jointly guided the process of community and stakeholder engagement. Public involvement activities ranged from public meetings to the distribution of press releases for local news outlets to meetings with local business communities and stakeholder groups. Ongoing coordination supported interactions with applicable local, state, and federal resource agencies that would participate in the DEIS process. Coordination activities were also developed for local government agencies to ensure the public involvement process generated input from a wide range of community members, such as civic leagues and business organizations.

Public meetings were held in various locations within the VBTES Corridor from September 2009 through November 2014. Over 700 participants attended the public meetings during this five year period. Other forums for public involvement initiatives generally adhered to the same meeting format, involving a presentation by HRT and subsequent open question and answer discussion. Other methods of public involvement included maintaining a website throughout the study process where documents distributed at public meetings were made available. Interested parties were also able to comment on the VBTES through the project page of HRT's website, by letters, e-mail, or telephone.

Table ES.2-1A | Summary of Impacts: Project Alternatives (LRT)

LRT Alternatives	Alternative 1A: Town Center	Alternative 1B: Rosemont	Alternative 2: NSRR	Alternative 3: Hilltop
Station Locations	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (4 site options, new Park & Ride)	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride)	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride) •Lynnhaven (new Park & Ride) •North Oceana (new Park & Ride) •Convention Center •Oceanfront	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride) •Lynnhaven (new Park & Ride) •Great Neck (new Park & Ride) •Hilltop West •Hilltop East (new Park & Ride) •Birdneck (new Park & Ride) •Convention Center •Oceanfront
Capital Cost				
•Current Year Dollars (2013)	Town Center West: **$240 M*** Independence/Market/Constitution: **$279 M*** ($27.7 M real estate already owned by City)	**$374 M*** ($34.5 M real estate already owned by City)	**$828 M*** ($58.1 M real estate already owned by City)	**$1,077 M*** ($55.4 M real estate already owned by City)
•Year of Expenditure (~2018)	Town Center West: **$279 M*** Independence/Market/Constitution: **$327 M*** ($30.5 M real estate already owned by City)	**$436 M*** ($37.3 M real estate already owned by City)	**$967 M*** ($61.2 M real estate already owned by City)	**$1,255 M*** ($59.3 M real estate already owned by City)
Operations and Maintenance (O&M) Costs				
•Estimated Cost to Operate and Maintain LRT Extension (2014 Dollars)	**$2.2 M** Local Share: $1.3 M	**$3.3 M** Local Share: $2.0 M	**$10.6 M** Local Share: $6.2 M	**$10.9 M** Local Share: $6.4 M
•Estimated Cost to Operate and Maintain Local Bus and Wave Services, including New Feeder Routes, in Virginia Beach (2014 Dollars)	**$18.6 M** Local Share: $7.1 M *(Increase of $3.1 M over FY 14 Budget)*	**$18.4 M** Local Share: $7.0 M *(Increase of $3.0 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*
Ridership Forecast				
•Average Weekday Boardings (Forecast Year 2034)	**2,250 Virginia Beach Only** 7,050 Norfolk Only 9,300 Total System	**3,370 Virginia Beach Only** 7,180 Norfolk Only 10,550 Total System	**5,295 Virginia Beach Only** 7,535 Norfolk Only 12,830 Total System	**8,845 Virginia Beach Only** 7,820 Norfolk Only 16,665 Total System
•Annualized Ridership (Forecast Year 2034)	2,838,000	3,219,000	3,915,000	5,085,000
•Annualized Ridership w/ Visitor Boardings (2034)	2,940,000	3,321,000	4,255,000	5,425,000

Source: HDR, 2014 ** Costs rounded to nearest $1 million*

Table ES.2-1B | Summary of Impacts: Project Alternatives (BRT)

BRT Alternatives	Alternative 1A: Town Center	Alternative 1B: Rosemont	Alternative 2: NSRR	Alternative 3: Hilltop
Station Locations	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (4 site options, new Park & Ride)	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride)	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride) •Lynnhaven (new Park & Ride) •North Oceana (new Park & Ride) •Convention Center •Oceanfront	•Newtown Road (existing Park & Ride) •Witchduck (new Park & Ride) •Town Center (3 site options, new Park & Ride) •Rosemont (new Park & Ride) •Lynnhaven (new Park & Ride) •Great Neck (new Park & Ride) •Hilltop West •Hilltop East (new Park & Ride) •Birdneck (new Park & Ride) •Convention Center •Oceanfront
Capital Cost				
•Current Year Dollars (2013)	Town Center West: **$227 M*** Independence/Market/Constitution: **$270 M*** ($27.7 M real estate already owned by City)	**$330 M*** ($34.5 M real estate already owned by City)	**$594 M*** ($58.1 M real estate already owned by City)	**$722 M*** ($55.4 M real estate already owned by City)
•Year of Expenditure (~2018)	Town Center West: **$264 M*** Independence/Market/Constitution: **$315 M*** ($30.5 M real estate already owned by City)	**$384 M*** ($37.3 M real estate already owned by City)	**$693 M*** ($61.2 M real estate already owned by City)	**$839 M*** ($59.3 M real estate already owned by City)
Operations and Maintenance (O&M) Costs				
•Estimated Cost to Operate and Maintain BRT Extension (2014 Dollars)	**$1.7 M** Local Share: $0.9 M	**$1.9 M** Local Share: $0.9 M	**$3.8 M** Local Share: $1.8 M	**$4.3 M** Local Share: $2.1 M
•Estimated Cost to Operate and Maintain Local Bus and Wave Services, including New Feeder Routes, in Virginia Beach (2014 Dollars)	**$18.6 M** Local Share: $7.1 M *(Increase of $3.1 M over FY 14 Budget)*	**$18.4 M** Local Share: $7.0 M *(Increase of $3.0 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*
Ridership Forecast				
•Average Weekday Boardings (Forecast Year 2034)	**2,340 Total BRT** 1,440 Virginia Beach Only 5,430 LRT (Norfolk) + 900 BRT (Newtown Road) **7,770 Total System**	**2,960 Total BRT** 1,980 Virginia Beach Only 5,460 LRT (Norfolk) + 980 BRT (Newtown Road) **8,420 Total System**	**4,395 Total BRT** 3,365 Virginia Beach Only 6,425 LRT (Norfolk) + 1,030 BRT (Newtown Road) **10,820 Total System**	**6,730 Total BRT** 5,690 Virginia Beach Only 6,655 LRT (Norfolk) + 1,040 BRT (Newtown Road) **13,385 Total System**
•Annualized Ridership (Forecast Year 2034)	2,371,000	2,569,000	3,302,000	4,084,000
•Annualized Ridership w/ Visitor Boardings (2034)	2,473,000	2,671,000	3,642,000	4,424,000

Source: HDR, 2014

** Costs rounded to nearest $1 million*

Table ES.3-1 | Summary of Impacts: Transportation

		Alternative 1A: Town Center		Alternative 1B: Rosemont		Alternative 2: NSRR		Alternative 3: Hilltop	
Summary of Impacts: Transportation (Chapter 3)	**Evaluation Measure**								
Traffic		LRT	BRT	LRT	BRT	LRT	BRT	LRT	BRT
	Quantity of intersections that would experience level of service E or F	3	3	5	5	7	7	8	8
	Number of grade-separated crossings	2	2	2	2	5	5	6	5
	Locations of grade-separated crossings	•Witchduck Road •Independence Boulevard (if Independence, Market, or Constitution Station Option is selected)		•Witchduck Road •Independence Boulevard		• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • London Bridge Road		• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • Virginia Beach Blvd./Great Neck Rd./Laskin Rd. (LRT only) • First Colonial Road	
Transit		LRT	BRT	LRT	BRT	LRT	BRT	LRT	BRT
	Enhanced bus services and increased number of service hours	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Total number of system boardings at proposed and existing transit stations	9,300	7,770	10,550	8,420	12,830	10,820	16,665	13,385
Parking		LRT	BRT	LRT	BRT	LRT	BRT	LRT	BRT
	Quantity of existing parking spaces at proposed transit stations	249	249	249	249	429	429	979	979
	Projected parking demand at proposed transit stations	470	318	553	325	785	496	914	580
	Quantity of proposed parking spaces proposed for alternative	480	480	655	655	1,105 + shared	1,105 + shared	1,480 + shared	1,480 + shared
Bikeways and Pedestrian Facilities	Number of roadways with existing sidewalks intersecting the build alternatives	5		6		18		2	

Source: HDR, 2014

Table ES.4-1 | Summary of Impacts: Social Effects

		Alternative 1A: Town Center	Alternative 1B: Rosemont	Alternative 2: NSRR	Alternative 3: Hilltop
Summary of Impacts: Social Effects (Chapter 4)	**Evaluation Measure**				
Land Use	Consistent with adopted planning and policy documents	Yes	Yes	Yes	Yes
Economic Development	Supports economic development goals outlined in citywide planning documents	Yes	Yes	Yes	Yes
Acquisitions and Displacements	Type of acquisition/displacement and number of properties affected	Total: 13 Partial: 12 Displacements: 7	Total: 20 Partial: 13 Displacements: 7	Total: 29 Partial: 47 Displacements: 31	Total: 47 Partial: 101 Displacements: 53
Cultural Resources	Resources directly affected	Not identified	Not identified	Not identified	Not identified
Parklands	Acres permanently affected Properties impacted	None None	None None	None None	2,900 sq. ft. 1
Visual Quality	Extent of impacts	Low	Low	Low	Low
Safety and Security	Safety measures included in design	Yes	Yes	Yes	Yes
Community Facilities	Number of community facilities within VBTES Corridor Community facilities permanently impacted	23 None	41 None	83 None	92 None

Source: HDR, 2014

Table ES.5-1 | Summary of Impacts: Environmental Effects

		Alternative 1A: Town Center	Alternative 1B: Rosemont	Alternative 2: NSRR	Alternative 3: Hilltop
Summary of Impacts: Environmental Effects (Chapter 5)	**Evaluation Measure**				
Soils and Farmland	Degree of soil disturbance	No impacts anticipated	No impacts anticipated	No impacts anticipated	No impacts anticipated
	Area of farmland affected	No impacts anticipated	No impacts anticipated	No impacts anticipated	No impacts anticipated
Water Quality	Change to impervious surface area	Low Increase	Low Increase	Low Increase	Low Increase
Wetlands	Quantity of acres potentially affected	3.58	5.17	10.49	8.82
Floodplains	Quantity of acres affected within 100 year floodplain	0.6	2.1	3.9	9.3
Navigable Waterways	Number of waterways affected	0	1	2	3
Habitat and Wildlife	Impacts to natural habitat	Minimal	Minimal	Minimal	Minimal
	Quantity of federally and state recognized species affected	0	0	0	0
Air Quality	Potential change to air quality	Negligible	Negligible	Negligible	Negligible
Noise and Vibration	Number of potential moderate or severe impacts to buildings	Noise: LRT - 2 moderate, 5 severe BRT - 1 moderate, 0 severe Vibration: LRT - 7 buildings BRT - 0 buildings	Noise: LRT - 4 moderate, 8 severe BRT - 1 moderate, 0 severe Vibration: LRT - 10 buildings BRT - 0 buildings	Noise: LRT - 11 moderate, 19 severe BRT - 2 moderate, 0 severe Vibration: LRT - 21 buildings BRT - 0 buildings	Noise: LRT - 6 moderate, 17 severe BRT - 2 moderate, 0 severe Vibration: LRT - 21 buildings BRT - 0 buildings
Hazardous Materials	Quantity of Hazardous Materials Sites within or Adjacent to the LOD	Within: 11 Adjacent: 7	Within: 11 Adjacent: 11	Within: 37 Adjacent: 24	Within: 57 Adjacent: 19
Energy	Change in energy consumption	Low	Low	Low	Low

Source: HDR, 2014

Chapter 1 | Purpose and Need

1.0 Purpose and Need

The Federal Transit Administration (FTA), as the lead Federal agency, and Hampton Roads Transit (HRT), as the joint lead agency, have prepared this Draft Environmental Impact Statement (DEIS) to examine the potential impacts and benefits of a range of alternatives for extending high capacity fixed guideway transit service from the eastern terminus of The Tide, HRT's light rail transit (LRT) system, east towards the Oceanfront Resort Area in Virginia Beach. This DEIS and the supporting studies referenced herein are known collectively as the Virginia Beach Transit Extension Study (VBTES).

The study area for this DEIS (the VBTES Corridor) (shown in **Figure 1.0-1**) extends from The Tide's Newtown Road Station to the Virginia Beach Oceanfront Resort Area. The corridor includes Interstate 264 (I-264), Virginia Beach Boulevard and Laskin Road (US 58 and Business 58), and the former Norfolk Southern Railway (NSRR) right-of-way (ROW). This chapter defines the purpose and need for the build alternatives, describes the study area and the transportation system context for the project including the history of the project, and provides the relationship between the VBTES, Virginia Beach's current land use, and the City's plans for strategic growth.

1.1 Purpose of the Project

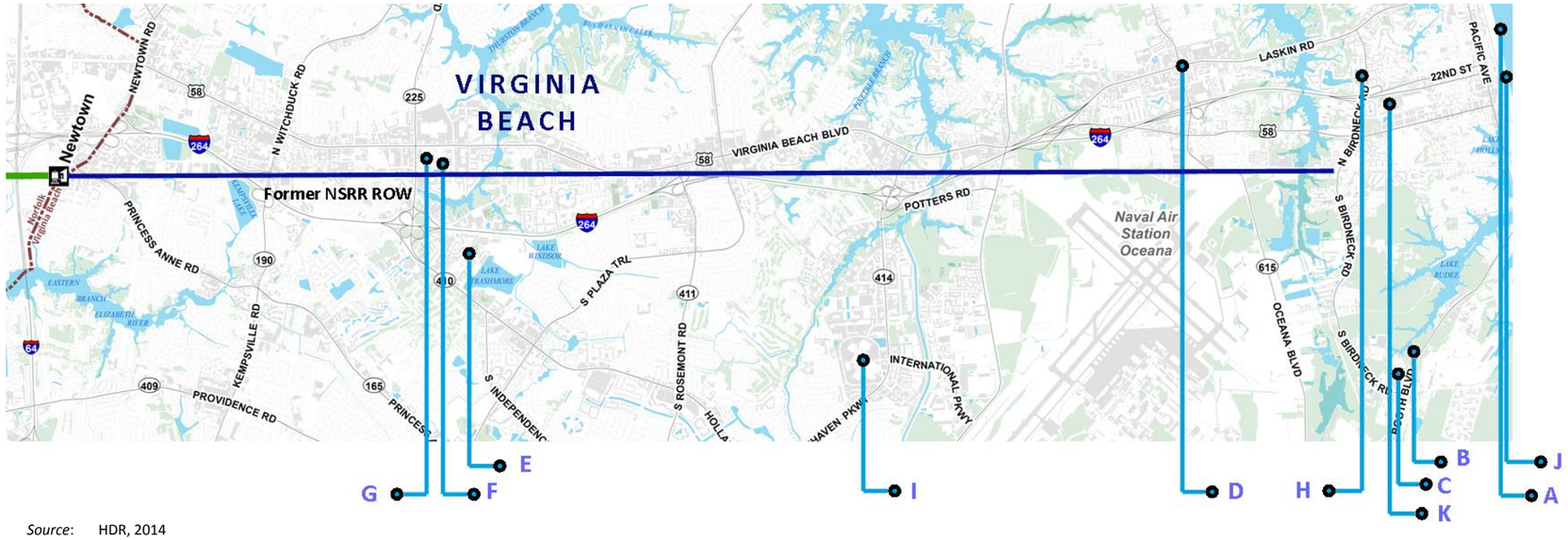
The primary purpose of providing a fixed guideway transit extension in the study corridor is to:

- Support the City of Virginia Beach's plans to limit suburban-style growth and development.
- Improve transportation and transit system efficiency and intermodal connectivity.

As part of their comprehensive planning efforts, the City of Virginia Beach has identified eight Strategic Growth Areas (SGAs) within the City. The goal of these SGAs is to provide opportunities for continued physical and economic growth; help prevent urban sprawl; protect established residential neighborhoods and rural/agricultural areas from incompatible development; maximize infrastructure efficiency; and create unique and exciting urban destinations. Six of the eight identified SGAs– Newtown, Pembroke (Town Center), Rosemont, Lynnhaven, Hilltop, and Resort (Oceanfront) - are within the VBTES Corridor. The development of a high capacity fixed guideway transit system connecting these SGAs to each other and to The Tide is a key element in the City's plans to reduce automobile dependency and provide opportunities for shorter work trips by focusing on mixed-use and transit oriented development. Currently, connections between these SGAs and The Tide are limited to the existing congested roadway network and a limited network of local bus routes.

A fixed guideway transit system, such as a light rail extension of the Tide or a bus rapid transit (BRT) system, would provide a transportation alternative that contributes to the livability of the city and its neighborhoods by reducing congestion, reducing air pollution, and supporting land use patterns that reduce energy use. Fixed guideway transit systems such as the build alternatives described in **Chapter 2**, can improve local and regional mobility for residents, workers, and visitors and encourage economic development along their fixed infrastructure.

Figure 1.0-1 | VBTES Corridor and Key Destinations



Source: HDR, 2014

1.2 Need for the Project

The Virginia Beach transit extension is needed to address the following transportation challenges in the corridor:

- East-west mobility is limited to a few congested roadways.
- The lack of mobility choices in the study corridor is impacting the largest economic engines in the City.
- Transit service in the corridor is impacted by congestion levels causing it to be slow and unreliable.

Limited east-west mobility.

East-west mobility in the study area is limited to I-264, Virginia Beach Boulevard, and Laskin Road. I-264 and Virginia Beach Boulevard provide the only continuous east-west travel options between Norfolk and the Oceanfront Resort Area. Combined with Laskin Road, these roads create the primary east-west transportation corridor that serves as local access to businesses, provides for daily commuting and

Table 1.2-1| Key Tourist Destinations

ID	Key Tourist Destinations
A	Virginia Beach Oceanfront Resort Area and Board-walk
B	Virginia Aquarium and Marine Science Center
C	Ocean Breeze Water Park
D	Hilltop Area Shopping and Dining
E	Mount Trashmore Park
F	Virginia Beach Town Center Shopping and Dining
G	Sandler Center for the Performing Arts
H	Museum of Contemporary Arts
I	Lynnhaven Mall
J	Old Coast Guard Station
K	Virginia Beach Convention Center

Source: HDR, 2014

tourist travel, and supports military readiness in the Hampton Roads region. The VBTES Corridor is the commercial spine of the City. These roadways link all of the major activity centers in the VBTES Corridor and allow access to the rest of the region. Presently, I-264, Virginia Beach Boulevard, and Laskin Road are all constrained by existing land use and development. Expanding these facilities to provide capacity beyond what is currently planned would potentially require the acquisition of hundreds of homes and businesses and would impact wetlands and other natural resources.

Lack of mobility choices is impacting the largest economic engines in the city.

There are two major economic engines for the City of Virginia Beach— the United States Military, primarily the U.S. Navy, and Oceanfront Resort Area tourism. The military comprises the largest employer in Virginia Beach and the Hampton Roads region. The U.S. Navy alone provides $14.9 billion in regional direct economic impact (Navy MIDLANT PAO, 2012). The City of Virginia Beach has three major military facilities: Naval Air Station (NAS) Oceana (in the VBTES Corridor), NAS Oceana Dam Neck Annex, and Joint Expeditionary Base (JEB) Little Creek-Fort Story. Combined, these bases employ more than 23,000 military and 5,300 civilians.

In 2011, the Hampton Roads Transportation Planning Organization (HRTPO), the region's metropolitan planning organization (MPO), completed the *Hampton Roads Military Transportation Needs Study* to determine military transportation needs in the area. The study noted several concerns regarding the area's transportation that were identified by military representatives, including:

- Military mobility is currently impeded by insufficient local transportation infrastructure.
- Transportation congestion and problems may hinder the ability to maintain or bring additional military personnel to the region.
- Local traffic congestion affects every day commuting for military personnel as well as travel times between installations during business hours.
- Traffic congestion adversely affects overall quality of life for service members and their dependents.

In 2012, the HRTPO conducted the *Military Commuter Survey,* a voluntary web-survey of military employees that received 10,994 responses, including 4,114 responses from military employees living in Virginia Beach. Seventy-nine percent (79%) of those responding to the survey identified traffic congestion as a key transportation problem during their daily commute. Nearly 5,000 respondents also indicated they travel frequently between military facilities in Hampton Roads. Of these 5,000, 77% identified traffic congestion as a problem affecting their travel. Sixty percent (60%) of the total respondents indicated they would be interested in a rail transit alternative for daily commuting if it were available. The survey also showed that the vast majority of these people (90.4%) travel to work in single occupancy vehicles and, therefore, are experiencing and contributing to the congestion and delay in the VBTES corridor daily. Their responses indicated that they felt better transit was a solution and that they would use a light rail transit system to access these destinations if it were available.

Tourism is also one of the largest components of the City of Virginia Beach's economic base. The City's more than 35 miles of beaches along the Chesapeake Bay and Atlantic Ocean are the primary draw for tourists. The popular Atlantic Ocean beaches are anchored by the three-mile long Oceanfront Resort Area boardwalk. The Oceanfront Resort Area (shown in **Figure 1.2-1**) is home to most of Virginia Beach's 12,000 hotel rooms. The *2012 Virginia Beach Fact Sheet*, compiled by the Virginia Beach Convention & Visitors Bureau, profiles the tourist industry as follows:

"Approximately 5.5 million people visit overnight in Virginia Beach annually, spending $1.13 billion. Typically, the Virginia Beach summer visitor (May through September) is between 35 and 54 years old, married with children. Over a third of these visitors earns an average household income of more than $100,000 and spends, on average, over $2,000 during their visit. A large majority of visitors arrive from the mid-Atlantic region."

Figure 1.2-1 | Virginia Beach Oceanfront Resort Area

Source: Virginia Beach Convention & Visitor's Bureau, 2013

Total overnight lodging sales in Virginia Beach were over $301 million in 2012, an increase of 7.9% over 2011 (www.VBgov.com).

The City of Virginia Beach Comprehensive Plan (2009) notes that ninety-five percent of all visitors come by private vehicles and that two of every three of these visitors reach the area via the Hampton Roads Bridge Tunnel on I-64 to I-264. The primary tourist destination is the Oceanfront Resort Area and the Atlantic Ocean beaches, but tourists also travel locally to shopping, dining, commercial, and other recreational venues (see **Table 1.2-1**) The Comprehensive Plan also noted that traffic congestion leads the list of identifiable factors people liked least about Virginia Beach and that one in three visitors indicated considerable difficulty with local traffic.

Slow and unreliable transit travel service on the congested roadway system.

There are nineteen HRT bus transit routes operating partially or entirely within the City of Virginia Beach. Fifteen of these routes serve the VBTES Corridor and include local bus service, express routes, and three seasonal routes serving the Oceanfront Resort Area. Route 20, operating from 5:00 a.m. until 1:00 a.m. weekdays along Virginia Beach Boulevard through the VBTES Corridor is the highest ridership route in the HRT system. The Route 20 is slow and has frequent stops. The route is frequently off schedule as it operates on congested roadways in the VBTES Corridor between SGAs.

1.3 Project History

The potential development of improved transit in the study corridor and specifically the implementation of a light rail transit system along the former NSRR ROW have been studied extensively over the past three decades.

In 1986, Tidewater Regional Transit (TRT), a predecessor agency of HRT, researched the need for and feasibility of providing additional transit service for the south side of the Hampton Roads region. In May 1986, TRT published the *Study of the Cost Effectiveness of Restoring Rail Passenger Service*. Through this study, TRT determined that fixed guideway transit such as LRT was a feasible transit alternative for the region, particularly in the Norfolk-Virginia Beach Corridor. Following the *Planning for Restoration of Rail Passenger Service* and *The Rail Systems Analysis and Fixed Guideway Service Plan* studies (TRT, 1988 and 1991, respectively), TRT identified the need to provide substantially improved bus transit service for the short term and LRT in the longer term within the VBTES Corridor.

In 1995, TRT initiated a Major Investment Study (MIS) to examine all of the possible transit solutions to transportation issues in a 30-mile corridor extending from the Oceanfront Resort Area in Virginia Beach through downtown Norfolk to Naval Station Norfolk. The MIS built upon past planning efforts by evaluating the feasibility of implementing various transportation alternatives and documenting the selection of a Locally Preferred Alternative (LPA). The MIS examined a congestion management system option, a series of high occupancy vehicle lanes, an I-264 busway, LRT on the former NSRR ROW, an I-264 LRT system, and a Virginia Beach Boulevard LRT system. In May 1996, the Tidewater Transportation District Commission (TTDC) selected LRT on the former NSRR ROW option as the LPA for the corridor.

From 1998 through 2000, TRT, which became HRT in 1999 through a merger with Pentran, the transit agency operating in Hampton and Newport News on the Peninsula, prepared a DEIS and Final Environmental Impact Statement (FEIS) documenting the potential impacts and benefits of a light rail transit system linking downtown Norfolk to the Virginia Beach Oceanfront Resort Area along the former NSRR ROW. The Preferred Alternative consisted of an 18-mile light rail transit system beginning at the western terminus in downtown Norfolk and proceeding to the eastern terminus near the Oceanfront Resort Area. The project components included:

- A LRT system comprised of an exclusive double track fixed guideway generally following the NSRR ROW.
- Thirteen stations, including seven east of Newtown Road in Virginia Beach.
- An expanded bus feeder network providing strong bus connections to the LRT line and extending the service coverage of the LRT system.
- A vehicle shop and maintenance facility to be located in Virginia Beach on City property near NAS Oceana.
- Elevated grade separations for crossing Rosemont Road, Princess Anne Road, Witchduck Road, and Independence Boulevard.

The preferred alignment followed the former NSRR ROW from Brambleton Avenue in Norfolk to Mesoney Road in Virginia Beach. East of Mesoney Road, the Preferred Alignment used local streets and other rights-of-way to the eastern terminus at the Pavilion Station located on the south side of 19th Street and opposite the Pavilion Convention Center between Park Avenue and Washington Avenue.

However, following a public referendum in 1999, the City of Virginia Beach opted out of the project proposed in the Norfolk to Virginia Beach LRT project FEIS. In 2000, Norfolk proceeded with the development of a light rail system within its city boundaries. The Tide LRT line was built, and the system opened for revenue service within the City of Norfolk in August 2011 with an eastern terminus at Newtown Road adjacent to the Virginia Beach city boundary.

In 2008, Virginia General Assembly HB 6028 directed HRT to initiate a study for the proposed extension of The Tide to the Oceanfront Resort Area in Virginia Beach. Supported by the Virginia Beach City Council and the HRTPO, the VBTES was initiated in 2009 as a Supplemental DEIS (SDEIS) to the 2000 Norfolk to Virginia Beach LRT FEIS. The VBTES SDEIS was placed on hold in 2011 while the first year of Tide ridership and service were evaluated. In April 2012 the City of Virginia Beach requested that HRT include Hilltop Area alignment alternatives in the VBTES as a result of the City's SGA planning process. FTA authorized HRT to include the Hilltop Area alignment alternatives, and HRT re-started the study in October 2012.

Virginia Beach held a non-binding referendum in November 2012 asking "Should the City Council adopt an ordinance approving the use of all reasonable efforts to support the financing and development of The Tide light rail into Virginia Beach?" This time the public supported the project, with 62.7% of Virginia Beach voters voting "yes" to the referendum.

In 2013, FTA determined that significant time had lapsed since the original 2000 FEIS and that the regional conditions had changed significantly since that time. Based on the time delay and the regional changes, the project was re-classified as a Draft Environmental Impact Statement that built upon but was independent of previous studies. A Notice of Intent (NOI) for this VBTES DEIS was published by the FTA in the Federal Register on August 14, 2013.

1.4 Study Area and Existing Transportation System

1.4.1 Study Area Description

The VBTES Corridor (**Figure 1.0-1**) is located in the City of Virginia Beach's primary east-west transportation corridor. It extends approximately 11 miles from the eastern terminus of The Tide at Newtown Road eastward to the Oceanfront Resort Area. The VBTES Corridor is the commercial spine of the city. Residential neighborhoods and NAS Oceana are the primary land uses north and south of the VBTES Corridor. It consists of mostly auto-oriented, low-density development.

The VBTES Corridor boundary, defined as the area within which project impacts may occur, extends approximately 0.5 miles to the north and south of the former NSRR ROW and Laskin Road and to the east and west of Birdneck Road. The VBTES Corridor includes the growing Virginia Beach Town Center, the Virginia Beach Convention Center, Oceanfront Resort Area hotels and tourist attractions, and many of the City's prominent historical sites; medical, higher education, and other cultural institutions; and residential areas. It also includes six of Virginia Beach's eight SGAs - areas designated by the City for high-density, mixed use, transit-oriented development in support of long-term economic growth. The six SGAs within the VBTES Corridor are located along the City's east-west transportation corridor making them highly supportive of a fixed guideway transit system. The City's largest employer, NAS Oceana, is adjacent to the study area just south of the former NSRR ROW.

1.4.2 Existing Roadway System

The largest road in the VBTES Corridor is I-264. I-264 is a variable-width, limited-access interstate highway with up to six lanes per direction. At its widest point between Witchduck Road and Independence Boulevard, I-264 carries over 200,000 vehicles per day (Hampton Roads Weekday Traffic Volumes 2006-2011, HRTPO, 2012) making it one of the most heavily traveled highways in the State.

Virginia Beach Boulevard is a six to eight-lane urban arterial. Its busiest section carries 51,000 vehicles per day near Rosemont Road (HRTPO, 2012).

For the eastern half of the corridor, Laskin Road diverges from Virginia Beach Boulevard to serve the northern end of the Oceanfront Resort Area and the Hilltop SGA. Laskin Road is a four lane divided arterial that carries about 36,000 vehicles daily (HRTPO, 2012) near its intersection with First Colonial Road.

Laskin Road is under design by Virginia Department of Transportation (VDOT) for reconstruction to eliminate the adjacent, parallel, "feeder roads" to provide more general purpose lanes. The proposed design for Laskin Road includes eight-lanes (four per direction), including a bike

path and sidewalks from Republic Road to Winwood Drive and six lanes (three per direction) from Winwood Drive to South Oriole Road. The Laskin Road project limits include the intersections at First Colonial Road and at Birdneck Road. This widening will maximize the available roadway right-of-way in this area without additional substantial impacts to adjacent businesses. Construction funding is not programmed in VDOT's current Six-Year Plan; consequently, construction may likely be delayed beyond 2018.

Intersecting with these three east-west roadways are several north-south major and secondary roadways. From west to east these include: Newtown Road, Witchduck Road, Independence Boulevard, Rosemont Road, Lynnhaven Parkway, London Bridge Road/ Great Neck Road, First Colonial Road/Oceana Boulevard, and Birdneck Road. Some of these roadways also experience long periods (2-1/4 to 3-1/2 hours) of reduced speed in the morning peak drive period from 7:00 to 9:00 a.m. (Witchduck Road, First Colonial Road) and in the afternoon peak drive period from 3:00 to 7:00 p.m. (Newtown Road, Lynnhaven Parkway, Witchduck Road, First Colonial Road) (Hampton Roads Regional Travel Time/Speed Study, HRTPO, April 2012).

Section 3.1 has additional information on the roadways and traffic conditions in the VBTES corridor.

1.4.3 Transit

As of November 2013, there are 19 HRT bus transit routes operating partially or entirely within the City of Virginia Beach. Fifteen of these routes serve the VBTES Corridor and include local bus service, express routes, and three seasonal routes serving the Oceanfront Resort Area. There are also four bus transfer points and one Park & Ride lot in the city (see **Figure 1.4-1**). The Route 20, operating from 5:00 a.m. until 1:00 a.m. weekdays along Virginia Beach Boulevard through the VBTES Corridor is the highest ridership route in the Hampton Roads Transit system. **Section 3.2** has additional information on transit in the corridor.

1.4.4 Key Travel Patterns and Modes

The City of Virginia Beach Comprehensive Plan (2009) identifies I-264 and Virginia Beach Boulevard as the backbone of Virginia Beach's transportation system, providing east-west access into, through, and out of much of the city. Both arterials serve the large retail and commercial centers located along the VBTES Corridor, including six of the City's SGAs, and accommodate through traffic as well as local and commercial trips. The VBTES Corridor is also intersected by a series of arterial roads serving north-south traffic that feed into the east-west corridor.

The VBTES Corridor includes the Newtown, Pembroke (Town Center), Rosemont, Lynnhaven, and Hilltop, and Resort Area SGAs (see **Figure 1.4-2**). Through its comprehensive planning process, the City has designated these areas to absorb future growth in Virginia Beach. Each SGA has a long range master plan that guides development in the area, and each SGA long range master plan calls for transit-related development.

The City's intent is to encourage higher density mixed-use, transit oriented development within the SGAs and thereby limit sprawl in other areas of the City. The SGAs will serve as key destination points and points of origin for local and regional travel. The identification of six SGAs along the travel corridor composed of I-264 and Virginia Beach Boulevard recognizes the existing land use patterns in the VBTES Corridor and positions future development to take advantage of existing transportation infrastructure. The planned growth will also create additional demand for alternative transportation modes - particularly high capacity, fixed guideway transit - within the VBTES Corridor.

Newtown SGA

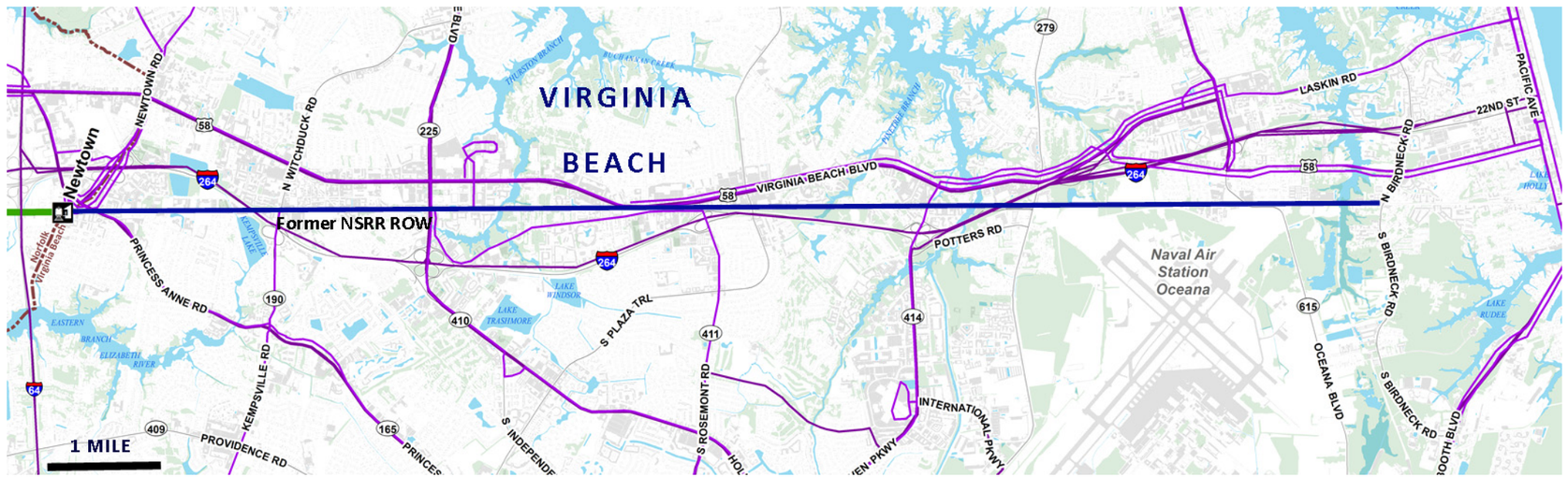
The Newtown SGA is a western gateway to the City of Virginia Beach. The area is currently developed with low to mid-rise structures representing a mix of office and light industrial uses. There are a number of undeveloped and underdeveloped sites located throughout this SGA. During development of the SGA Master Plan for Newtown, citizens cited heavy traffic and congestion as an area weakness (City of Virginia Beach Newtown SGA Master Plan 2010). The City's guiding recommendations for the Newtown SGA (City of Virginia Beach Comprehensive Plan Policy Document, 2009) include:

- Reinforce the Newtown site as the "Gateway" into Virginia Beach.
- Build mixed-use, mixed-income, transit-oriented development.
- Celebrate light rail as a centerpiece in a gateway public space.
- Coordinate transportation improvements including light rail.

Pembroke SGA

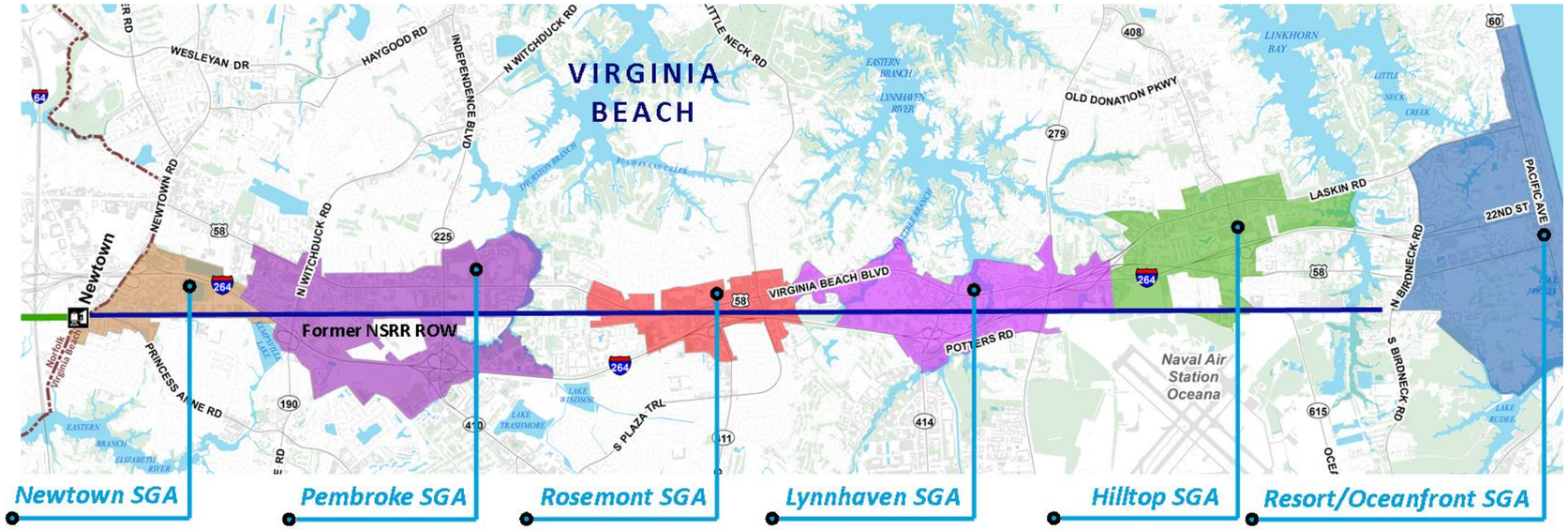
The Pembroke SGA is a 1,200 acre tract of land including some residential and institutional uses but dominated by commercial and industrial uses. The core of this SGA is the Town Center of Virginia Beach at Independence Boulevard and Virginia Beach Boulevard. Town Center is being developed as Virginia Beach's "Downtown" area. Town Center is a 25-acre development which includes more than

Figure 1.4-1 | Transit Network in the VBTES Corridor



Source: Hampton Roads Transit, 2013

Figure 1.4-2| Strategic Growth Areas Along the VBTES Corridor



Source: HDR, 2014

3.2 million square feet of development including Class A office space, retail space, a 1,200 seat performing arts center, two hotels, apartments, condominiums, and other urban amenities. Town Center is continuing to develop with additional areas under construction, in pre-construction, or in planning. At completion, Town Center is anticipated to have a population of 24,000 people living and working in over 4.3 million square feet of development (www.vabeachtowncenter.com).

Town Center has direct access to downtown Norfolk and to the Oceanfront Resort Area through I-264 and Virginia Beach Boulevard. One of the city's important north-south travel routes, Independence Boulevard, runs through the heart of Town Center. This makes Town Center a key market and travel hub for the city as both a major destination point and point of origin for regional travel.

The former NSRR ROW passes through Town Center. The City's comprehensive plan calls for transit-oriented development around planned transit stations in this SGA (City of Virginia Beach, 2009). During preparation of the Pembroke SGA Master Plan, residents cited traffic congestion and lack of rapid transit as challenges for the area (City of Virginia Beach Pembroke SGA Master Plan 2009).

Rosemont SGA

The Rosemont SGA is a 158-acre area located east of the Pembroke SGA along the east-west corridor. Land use is characterized by suburban strip commercial and multifamily residential uses along Virginia Beach Boulevard and established single family neighborhoods located north and south of the corridor. During preparation of the Rosemont SGA Plan, citizens cited the lack of transit connections to the neighborhoods as an area weakness (City of Virginia Beach Rosemont SGA Master Plan 2011). The City's comprehensive plan recommends transit-related improvements, including connectivity and mobility enhancements, to transition the Rosemont SGA from an auto-oriented retail strip to a mixed-use transit-oriented neighborhood center at higher densities.

Lynnhaven SGA

The Lynnhaven SGA takes its name from the Lynnhaven River system. It is generally bounded by the Rosemont SGA to the west, the Hilltop SGA to the east, and NAS Oceana to the southeast. The entire area is heavily impacted by Air Installation Compatible Use Zone (AICUZ) restrictions associated with flight patterns at NAS Oceana, including noise zones and two accident potential zones. The public cited traffic congestion, particularly on intersections along Virginia Beach Boulevard as an area weakness during the preparation of the Lynnhaven SGA Master Plan (City of Virginia Beach Lynnhaven SGA Master Plan 2012). The City envisions a potential new transit station at the center of this SGA could provide a Park & Ride lot, walking connections to nearby office uses, and transfer service to Lynnhaven Mall (City of Virginia Beach, 2009).

Hilltop SGA

The Hilltop SGA includes a variety of retail, restaurant, office, health, and recreational uses. The SGA is generally bound by a diverse mix of retail located north of Laskin Road, Lynnhaven SGA to the west, Linkhorn Bay to the east, and Potters Road to the south. Though this area is located within a high noise zone, it is a good candidate for redevelopment and reinvestment because of its existing commercial strength and its proximity to the Oceanfront Resort Area, NAS Oceana, and I-264 interchange. Commercial and retail development are considered compatible with the noise generated by the aircraft noise from NAS Oceana. The area south of I-264 is subject to greater AICUZ restrictions due to the presence of accident potential zones and the clear zone. Citizens cited traffic volumes, congested intersections, and feeder roads as well as lack of sufficient transit connections as area weaknesses during the preparation of the *Hilltop SGA Master Plan* (City of Virginia Beach Hilltop SGA Master Plan 2012).

Resort (Oceanfront) SGA

The Oceanfront Resort SGA is generally bounded by 42nd Street, the Atlantic Ocean, Rudee Inlet, and Birdneck Road. Revitalization efforts have transformed the Oceanfront Resort Area into a major activity center and economic growth engine for the City based on tourism. The City's comprehensive plan calls for bringing light rail transit from Norfolk through Town Center to the Oceanfront Resort Area via 19th Street. This corridor is viewed by the City as a prime location for multifamily housing, transit orientated development, retail, restaurants, and similar uses.

1.5 VBTES Relation to Other Plans and Studies

The critical need for fixed guideway transit in the VBTES Corridor has been identified in multiple planning and transit studies by HRT, the HRTPO, and the City of Virginia Beach. These plans and studies (discussed below) generally concur that:

- Increasing traffic congestion interferes with maintaining livable communities and a vibrant economy.
- Traffic congestion adversely affects the military component of the economy, and if the region is to continue to support the many military bases and

related centers of employment, there must be improved local and regional mobility.

- Similarly, traffic congestion adversely affects the tourism component of the economy, and if tourism is to continue to grow in Virginia Beach, mobility between the Virginia Beach Oceanfront Resort Area and other local and regional tourist attractions must be improved.

- Transit development should support the City's growth strategies that focus future growth in designated areas.

- A fixed guideway system (specifically identified in these plans and studies as a LRT system) is needed along the former NSRR ROW to connect The Tide with the Virginia Beach Convention Center and Oceanfront Resort Area, to connect designated growth areas along the City's east-west corridor, and to provide transportation options in that same east-west corridor.

The build alternatives under consideration by the VBTES are consistent with all of the recently adopted relevant City of Virginia Beach and Hampton Roads regional land use and transportation planning documents. All of these plans have expressed the need to expand high quality transit options in the VBTES Corridor.

1.5.1 Long Range Regional Plans

The *2034 Long Range Transportation Plan*, prepared by the HRTPO, identifies the need for fixed guideway transit from the end of line of The Tide at the Newtown Station to the Oceanfront Resort Area in Virginia Beach. The plan concludes that roadway congestion in Hampton Roads is some of the worst in the country and that this roadway congestion "…not only lowers the quality of life in Hampton Roads but also impacts regional commerce, particularly in those critical sectors that depend heavily on the regional transportation network such as freight movement, tourism, and the military". The plan also identifies several congestion management strategies, including shifting trips from automobiles to other modes. The plan identifies high quality transit service as a necessary element to meet the growing mobility and accessibility needs of the Hampton Roads population and offset congestion.

The *Hampton Roads Regional Transit Vision Plan* (HRTPO, 2011) looks into the future, 2025 and beyond, to visualize what may be possible for the region's transit services. The plan creates the framework upon which a successful regional rapid transit network may be built. The Vision Plan considered many transit modes including LRT, street car, commuter rail, enhanced bus, express bus, BRT, and high speed ferry. The Vision Plan recommends extending The Tide into Virginia Beach via fixed guideway rapid transit – either LRT or BRT based on further study – as a short term priority (by 2025).

1.5.2 Local Plans

The City of Virginia Beach's Comprehensive Plan (2009) includes guiding principles that closely link land use and transportation. The City indicates that "compact development patterns afford greater choice of transportation alternatives and less congestion". The City's Strategic Growth Areas have been defined to accommodate urban growth. The goals of the SGAs are:

- Efficient use of land resources.
- Full use of urban services.
- Compatible mix of uses to live, work, play, learn, exercise, and relax.
- Range of transportation options.
- Human scale with safe, attractive urban design.

The SGAs represent a fundamental shift in land development and transportation planning in Virginia Beach and include introduction of fixed guideway transit investments as part of an integrated transit-land use strategy.

Several transportation system planning studies completed for the City of Virginia Beach have examined the feasibility of providing additional transit service in the VBTES Corridor. These studies were conducted with full public participation. Each study identified the need to provide an efficient, safe, economical, and balanced transportation system (with auto, transit, and non-motorized modes of travel) that would minimize the impact to the environment and would complement the community's development patterns. Development of a transit extension through Virginia Beach is discussed in the following City studies:

- *Hilltop SGA Master Plan*, 2012
- *Lynnhaven SGA Master Plan*, 2012
- *Rosemont SGA Master Plan*, 2011
- *Newtown SGA Master Plan*, 2010
- *Pembroke SGA Implementation Plan*, 2009
- *Virginia Beach Comprehensive Plan*, 2009
- *Virginia Beach Oceanfront Resort Area Plan*, 2005
- *Virginia Beach Central Business District Final Master Plan*, 1991

1.6 Public Involvement and Agency Coordination Program

A comprehensive public involvement program was implemented at the beginning of the 2009 VBTES SDEIS process and will be continued throughout the current VBTES DEIS project development and environmental review process to support decision-making. The program is guided by a Public Involvement Plan (PIP) that is described in full in **Chapter 8** and **Appendix L** to the DEIS.

The public involvement program for the DEIS is structured to collect information from many different audiences, such as citizens, interested communities, businesses, environmental groups, elected and appointed officials, agencies and jurisdictions, minorities, and low-income populations. The PIP includes specific efforts to include and accommodate the special needs of members of the public who may otherwise be under-represented such as minorities, low-wage earners, and people with disabilities. Specific opportunities for community interaction and input occurred at milestones throughout the study process to date as listed as follows:

- Initial VBTES SDEIS meetings to discuss project scope, schedule, and potential alternatives, September 2009;
- Station Area Workshops, December 2009;
- Hilltop Area Alignment Alternatives Meeting, February 2013;
- Station Area Workshops, March 2013;
- Cost and Ridership Workshops, September 2103;
- Alternatives Review Meetings, February 2014;
- DEIS Public Hearings, TBD.

The public involvement program includes a wide range of public outreach tools to ensure a well informed public. Public outreach tools include:

- Distribution of printed materials
- Press releases/media contacts/news articles
- Project webpage
- Facebook/Twitter links
- Presentations to community and business organizations
- Public meetings and hearings
- Stakeholder interviews

In addition to general public involvement programs, a Community Advisory Committee (CAC) was created to advise HRT and the City of Virginia Beach on issues and potential impacts related to the alternatives under consideration within the study corridor. The CAC is important to the process because its members provide unique input that combines ongoing, detailed knowledge of the project with the perspectives of community residents and business owners within the VBTES Corridor. The members also serve as important liaisons to their communities through formal neighborhood, civic, and business groups and informal networks of friends, coworkers, and neighbors. A record of the CAC meeting dates and topics of discussion is found in **Chapter 8**.

Coordination with resource and regulatory agencies was initiated in 2009 and is ongoing. Communications with

individual agencies occurred through the Technical Advisory Committee (TAC) and through direct agency correspondence to review data collection and analysis methodologies pertaining to the project. Participating agencies are invited to attend public meetings and to provide input during the DEIS process. Record of the TAC meeting dates and topics of discussion is found in **Chapter 8**.

Chapter 2 | Project Alternatives

2.0 Project Alternatives

The VBTES considered multiple alternatives that met the purpose and need for the project as described in Chapter 1. Alternatives include different modes and alignments as well as station locations, maintenance facility locations, and overall project lengths.

Section 2.1 describes the build alternatives under consideration in this DEIS. Both light rail and bus rapid transit alternatives were considered. This section describes the alternative routes, modes, station locations, vehicle maintenance areas, capital costs, and operation and maintenance costs. Conceptual design plans for the alternatives described in this section are in **Appendix G.**

Section 2.2 describes the No Build alternative. The No Build alternative is used as a baseline for comparing the effects associated with various build alternatives.

2.1 Build Alternatives

The build alternatives consist of a set of different transit alignments and modes that meet the purpose and need of the project. Four alignment alternatives were studied, each with two different transit modes (LRT and BRT modal alternatives) for a total of eight build alternatives. The alignments are described below and in greater detail in **Section 2.1.1**. Each of the four alignment alternatives was evaluated for LRT and BRT operations.

- **Alternative 1A: Newtown Road to the proposed Town Center Station (Town Center Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW to a new station in the vicinity of the Town Center of Virginia Beach (approximately 3 miles), as shown in **Figure 2.1-1A**.
- **Alternative 1B: Newtown Road Station to the proposed Rosemont Station (Rosemont Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW to a new station near Rosemont Road (approximately 4.8 miles), as shown in **Figure 2.1-1B**.
- **Alternative 2: Newtown Road Station to the proposed Oceanfront Station via the NSRR ROW (NSRR Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east to a proposed station in the Oceanfront Resort Area largely following the former NSRR ROW and including segments along Birdneck Road, 17th Street, Washington Avenue, and 19th Street (approximately 12.2 miles), as shown in **Figure 2.1-1C**.
- **Alternative 3: Newtown Road to the proposed Oceanfront Station via Laskin Road (Hilltop Alternative) –** an alternative alignment from The Tide station at Newtown Road extending east along the former NSRR ROW and then through the Hilltop SGA on Laskin Road to a new station in the Oceanfront Resort Area via Birdneck Road and 19th Street (approximately 13.5 miles), as shown in **Figure 2.1-1D**.

A detailed description of the proposed stations for all the alignments is in **Section 2.1.2**. The modal (vehicle-type) alternatives would have a physically similar fixed guideway separated from traffic in most locations, but they differ in terms of the type of transit vehicle, propulsion system, guideway design, and some operating characteristics. The system-wide components and operating characteristics of each mode are described in **Section 2.1.3**. The feeder bus network required to effectively operate the alignment alternatives is described in **Section 2.1.3** as well.

2.1.1 Alignment Alternatives

As stated in **Section 2.1**, there are four alignment alternatives under consideration for the VBTES—Town Center Alternative, Rosemont Alternative, NSRR Alternative, and Hilltop Alternative. A brief description of the alternatives is in the following section by mode (LRT and BRT). A summary of physical characteristics of the alternatives is in **Tables 2.1-3A** and **2.1-3B (LRT Alternatives)** and **Tables 2.1-4A** and **2.1-4B (BRT Alternatives)**. Conceptual engineering drawings for each of the alternatives are in **Appendix G.**

LRT Alternatives

ALTERNATIVE 1A: Newtown to Town Center (Town Center Alternative)

The Town Center Alternative would follow the former NSRR ROW from The Tide's Newtown Road Station to the proposed Town Center Station (See **Figure 2.1-1A**) (approximately 3 miles).

A new eastbound station platform would be constructed at the Newtown Road Station while the existing platform would serve the westbound direction. From the Newtown Road Station, this alignment alternative would travel east along the former NSRR ROW. The alignment would cross Newtown Road and Princess Anne Road at ground level (or "at-grade").

At the Princess Anne Road crossing, one driveway providing direct access to the property on the north side of Princess Anne Road would be closed to eliminate a conflict with the proposed guideway. Access to the property would be relocated by creating a driveway entrance at the west end of Southern Boulevard. A new traffic signal would be installed at the intersection of Princess Anne Road and Freight Lane to address safety concerns due to the short distance between the intersection and the track crossing. A new right turn lane would be installed for westbound Princess Anne Road at Freight Lane. These improvements are shown in **Figure 2.1-2.**

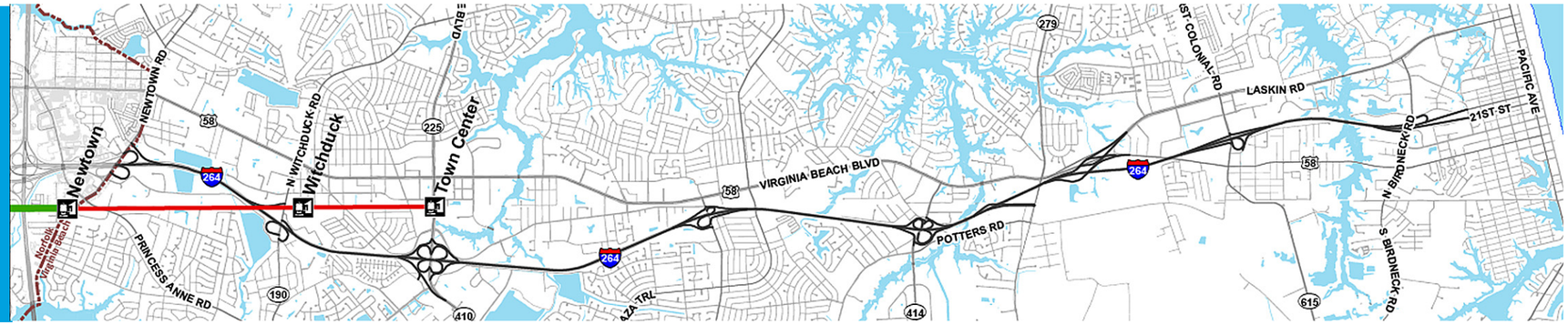
Figure 2.1-1 A | Alignment Alternatives

A

ALTERNATIVE 1A:

Newtown Road to the proposed Town Center Station

(Town Center Alternative)



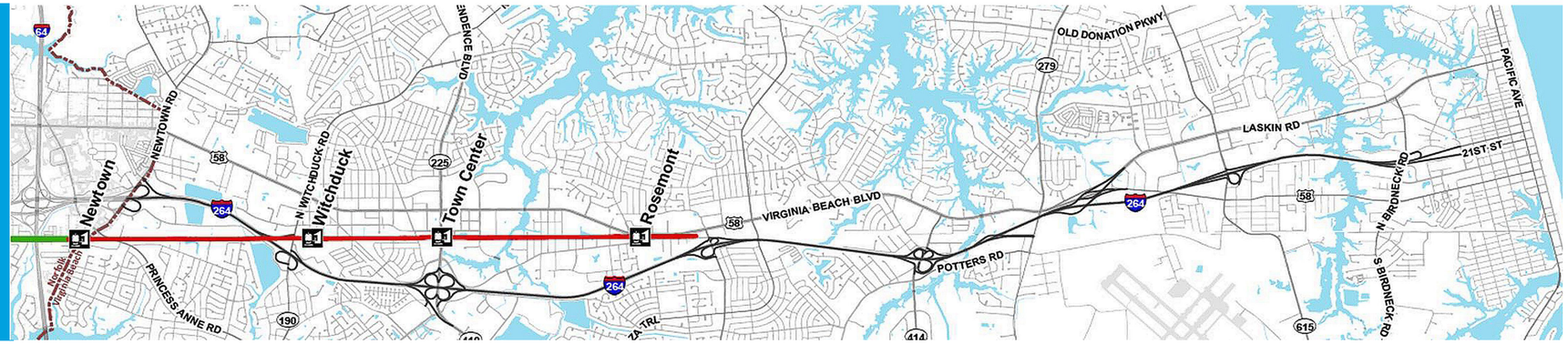
Source: HDR, 2014

Figure 2.1-1 B-D | Alignment Alternatives

B

ALTERNATIVE 1B:

Newtown Road Station to the proposed Rosemont Station (Rosemont Alternative)

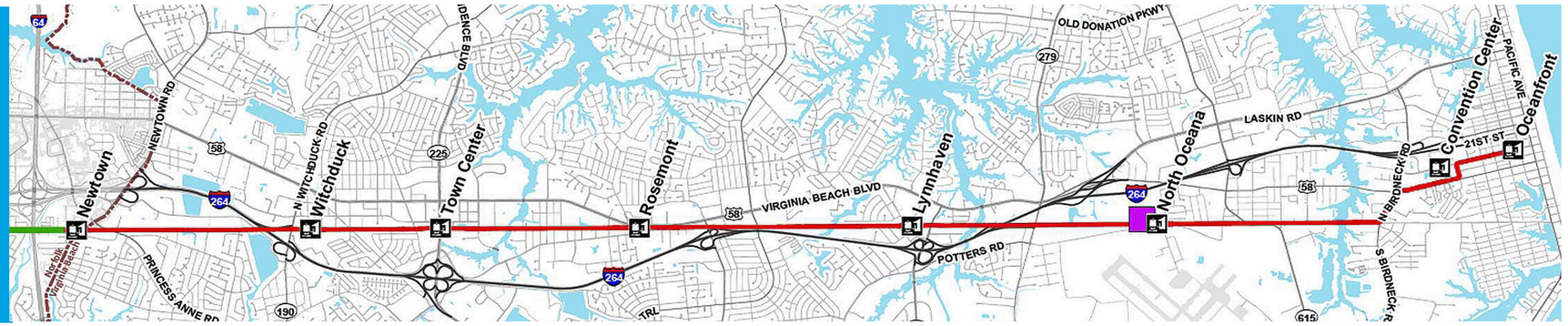


C

ALTERNATIVE 2:

Newtown Road Station to the proposed Oceanfront Station via the NSRR ROW

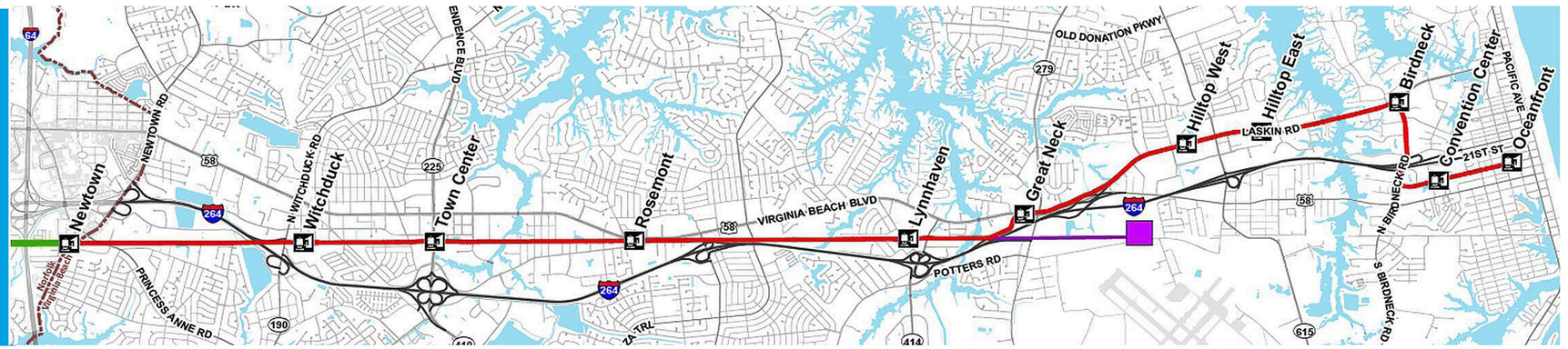
(NSRR Alternative)



D

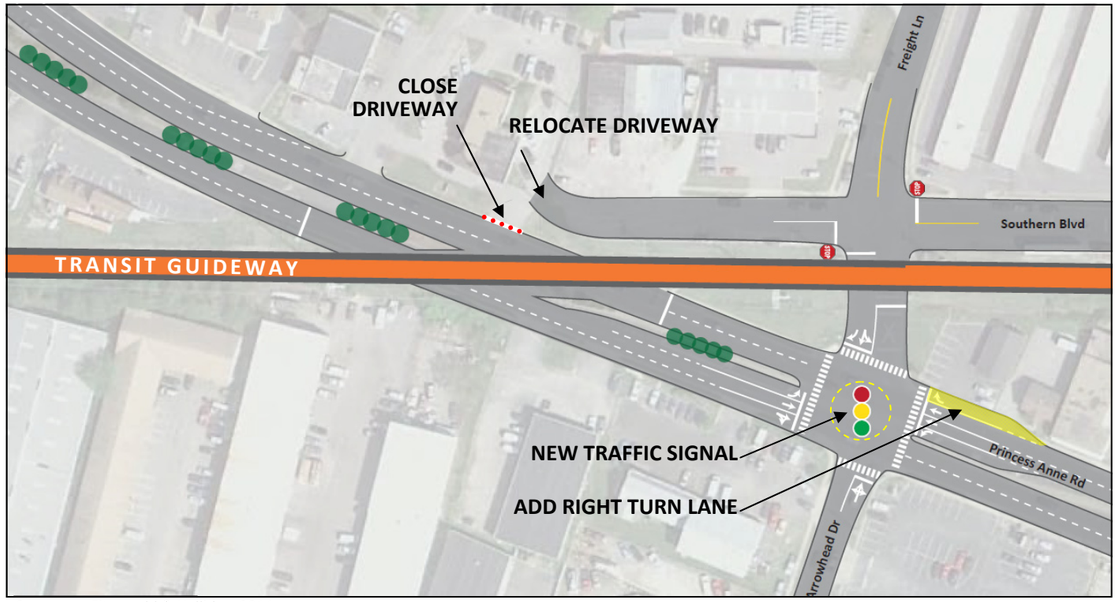
ALTERNATIVE 3:

Newtown Road to the proposed Oceanfront Station via Laskin Road (Hilltop Alternative)



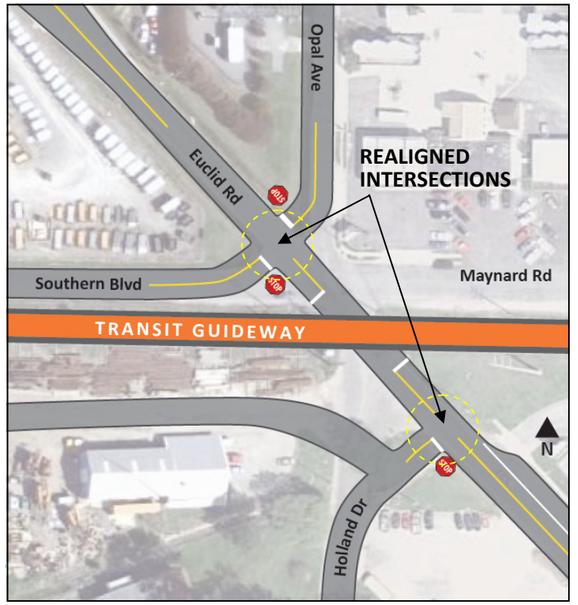
Source: HDR, 2014

Figure 2.1-2 | Roadway Improvements Near Princess Anne Road Crossing



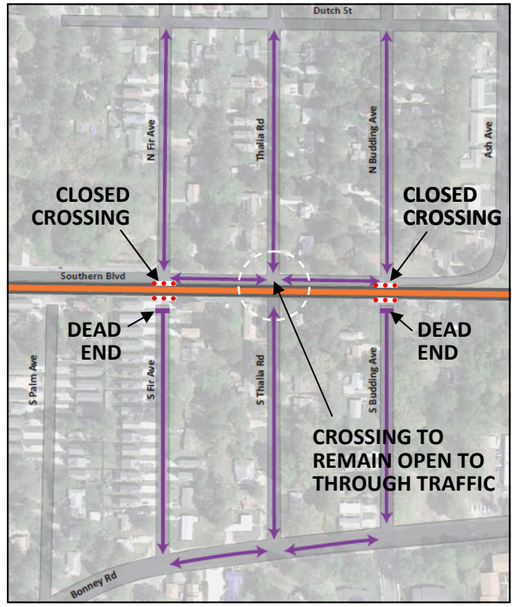
Source: Fitzgerald & Halliday, 2014

Figure 2.1-3 | Roadway Improvements Near Euclid Road Crossing



Source: Fitzgerald & Halliday, 2014

Figure 2.1-4 | Changes to Fir Avenue, Thalia Road, and Budding Avenue Crossings



Source: Fitzgerald & Halliday, 2014

Continuing east, the alignment would cross Greenwich Road at-grade and pass under the existing I-264 bridge before rising on a new bridge (or "grade-separated") over Witchduck Road. A station with a Park & Ride lot and bus transfer area would be located east of Witchduck Road adjacent to Southern Boulevard (see **Witchduck Station**, **Figure 2.1-7**).

Continuing east, the alignment would cross Euclid Road at-grade. As shown in **Figure 2.1-3**, the intersections of Euclid Road and Southern Boulevard/Opal Avenue and Euclid Road and Holland Drive are proposed to be realigned to increase the distance between the track crossing and the roadway intersections. The alignment would cross Kellam Road at-grade. In the vicinity of the Virginia Beach Town Center, various station sites are under consideration. For Alternative 1A, an end-of-line station with Park & Ride and bus loading area would be located at one of the following sites:

- At ground level and immediately west of Independence Boulevard with a pedestrian bridge over the Boulevard to connect to a park and ride on the east side of Independence Boulevard;
- On a new transit bridge starting east of Kellam Road over Independence Boulevard and Market Streets with the boarding platforms directly over Independence Boulevard;
- On a new transit bridge starting east of Kellam Road over Independence Boulevard and Market Streets with the boarding platforms directly over Market Street; or
- At ground level and immediately west of Constitution Drive (a new transit bridge would be required over Independence Boulevard and Market Street for this station site option). For this station location only, the alignment would end approximately 450 feet east of Constitution Drive to provide extra track for temporary vehicle storage (See **Town Center Station Options, Figures 2.1-8 A-D**).

ALTERNATIVE 1B: Rosemont Alternative

The Rosemont Alternative would follow the former NSRR ROW from The Tide's Newtown Road Station to the proposed Rosemont Station west of Rosemont Road (See **Figure 2.1-1B**) (approximately 4.8 miles).

From Newtown Road to Kellam Road, this alignment is the same as Alternative 1A.

East of Kellam Road, the alignment would rise to be grade separated over Independence Boulevard and Market Street. For Alternative 1B, a station would be located at one of the following sites in the vicinity of Virginia Beach Town Center:

- On a new transit bridge over Independence Boulevard and Market Street with the boarding platforms directly over Independence Boulevard;
- On a new transit bridge over Independence Boulevard and Market Street with the boarding platforms directly over Market Street; or
- At ground level and immediately west of Constitution Drive. (See **Town Center Station Options, Figure 2.1-8 B-D**).

From any of the Town Center Station options, the alignment would continue east across Constitution Drive at-grade. The alignment would cross Thalia Creek on a new two-track transit bridge. In the neighborhood east of Thalia Creek, existing crossings at Fir Avenue and Budding Avenue would be closed in order to avoid having multiple at-grade crossings in a short distance. South Fir Avenue and South Budding Avenue would become dead end streets south of the tracks (north of the tracks, those streets would end at Southern Boulevard, which runs parallel to the former NSRR ROW). An at-grade crossing of Thalia Road would remain. **Figure 2.1-4** illustrates the proposed changes to traffic patterns in this neighborhood.

The alignment would continue east across Kentucky Avenue and Lynn Shores Drive at-grade before entering the

Rosemont Station (**Figure 2.1-9**). The alignment would end approximately 400 feet east of the station leaving extra track for temporary vehicle storage. A Park & Ride lot and bus loading area would be located at the Rosemont Station.

ALTERNATIVE 2: NSRR Alternative

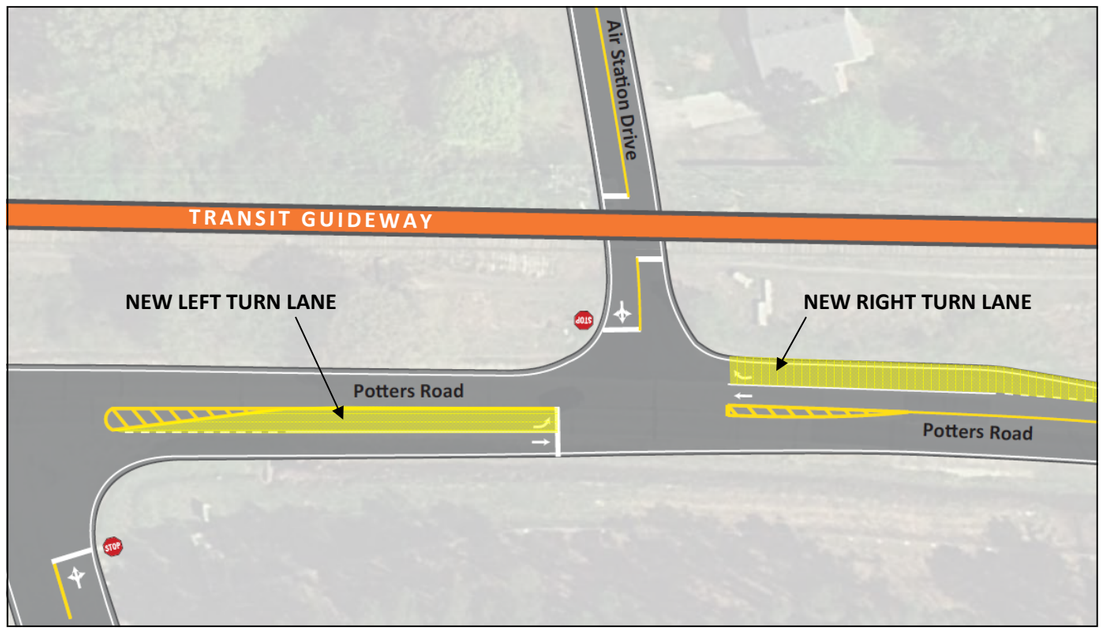
The NSRR Alternative would follow the former NSRR ROW from The Tide's Newtown Road Station to the Virginia Beach Oceanfront Resort Area (See **Figure 2.1-1C**) (approximately 12.2 miles).

From Newtown Road to the Rosemont Station, this alignment is the same as Alternative 1B.

Extending east from the proposed Rosemont Station, the alignment would rise to be grade separated over Rosemont Road. The alignment would cross South Plaza Trail at-grade. Past South Plaza Trail, the alignment would cross North Lynnhaven Road at-grade before coming to a station with a Park & Ride lot along Southern Boulevard between North Lynnhaven Road and Lynnhaven Parkway (See **Lynnhaven Station, Figure 2.1-10**).

After exiting the Lynnhaven Station, the alignment would rise to be grade separated over Lynnhaven Parkway. The alignment would then cross London Bridge Creek (Alternative 3 would proceed northeast from this point) on a new bridge and go under the existing I-264 overpass. After passing under I-264, Alternative 2 would rise to be grade separated over London Bridge Road. Continuing east from London Bridge Road, the alignment would come back to ground level and would continue along the former NSRR ROW immediately north of NAS Oceana. A vehicle storage and maintenance facility and a station with a Park & Ride lot would be located west of Air Station Drive (See **North Oceana Station, Figure 2.1-11**). Continuing east from the station, the alignment would remain at-grade and cross Air Station Drive. As shown in **Figure 2.1-5**, turn lanes would be added on Potters Road at Air Station Drive to provide additional space for vehicles due to the short distance between the crossing and Potters Road. The alignment would cross South First Colonial Road, Oceana Boulevard, Sykes Avenue, and Distribution Drive until it reaches Birdneck Road.

Figure 2.1-5 | Roadway Improvements Near Air Station Drive Crossing



Source: Fitzgerald & Halliday, 2014

At Birdneck Road, the alignment would turn off of the former NSRR ROW to the north into the median of Birdneck Road. At 17th Street (Virginia Beach Boulevard), the alignment would turn east and run along the north edge of 17th Street. At Washington Avenue, the alignment would turn north to pass through the parking lot at the Virginia Beach Convention Center. The **Convention Center Station** (**Figure 2.1-12A**) would be located immediately south of 19th Street. At 19th Street, the alignment would turn east into the median of 19th Street and would extend to the end-of-line **Oceanfront Station** (**Figure 2.1-13**) at the intersection of 19th Street and Arctic Avenue.

ALTERNATIVE 3: Hilltop Alternative

The Hilltop Alternative would follow the former NSRR ROW from The Tide's Newtown Road Station to London Bridge Creek and then Virginia Beach Boulevard, Laskin Road, and Birdneck Road to the Virginia Beach Oceanfront Resort Area (See **Figure 2.1-1D**) (approximately 13.5 miles).

From Newtown Road to London Bridge Creek, this alignment is the same as Alternative 2.

Just east of London Bridge Creek and west of the I-264 overpass, the alignment would leave the NSRR ROW onto its own alignment parallel to I-264. The alignment would then turn northeast on a bridge that would cross above Virginia Beach Boulevard and Great Neck Road. The **Great Neck Station** (**Figure 2.1-14**) would be located on the structure over Virginia Beach Boulevard west of Great Neck Road. The elevated alignment would continue north of Virginia Beach Boulevard/Laskin Road and would turn to cross over the westbound lanes of Laskin Road. The alignment, still on elevated structure, would continue south of the westbound lanes, over the I-264 on-ramp, and then touch down in the median of Laskin Road west of Phillip Avenue where the eastbound and westbound lanes of Laskin Road converge.

The alignment would continue in the median of Laskin Road. In order to provide sufficient width for the tracks, the Laskin Road traffic lanes would be moved and reconstructed to have three lanes in each direction (with additional turn lanes). The existing service roads on Laskin Road would be removed. A walk-up station would be located east of Republic Road (See **Hilltop West Station, Figure 2.1-15**). The alignment would rise on a bridge east of Hilltop Plaza Shopping Center just west of First Colonial Road. It would remain on structure over First Colonial Road and would touch down again in the median of Laskin Road near Nevan Road. The alignment would continue in the median of Laskin Road, and a new station would be located near the entrance to the Hilltop East Shopping Center (See **Hilltop East Station. Figure 2.1-16**).

The alignment would continue east in the median of Laskin Road until it intersects with Birdneck Road. Here, the alignment would turn south onto the median of Birdneck Road. A station would be located in the median of Birdneck Road south of Laskin Road, and a Park & Ride lot would be located southeast of the intersection of Laskin Road and Birdneck Road (See **Birdneck Station, Figure 2.1-17**). The alignment would continue in the median of Birdneck Road including under I-264 until it reaches 19th Street.

At 19th Street the alignment would turn east into a new median of 19th Street. West of Jefferson Avenue would be a station to serve the Virginia Beach Convention Center (**Figure 2.1-12B**). This station would use existing Convention Center parking lots when available. The alignment would continue in the median of 19th Street to its terminal station west of Arctic Avenue. (See **Oceanfront Station, Figure 2.1-13**).

BRT Alternatives

The BRT alternatives are substantially the same as the LRT alternatives. For all BRT Alternatives, at the Newtown Road Station there would be modifications to the existing bus loading area to accommodate BRT vehicles including a level boarding platform area similar to other proposed BRT stations. Alignment-specific differences are noted in the following section.

ALTERNATIVE 1A: Town Center Alternative

The BRT-version of Alternative 1A would be the same as the LRT version described on the previous pages.

ALTERNATIVE 1B: Rosemont Alternative

The BRT-version of Alternative 1B would be the same as the LRT version described on the previous pages.

ALTERNATIVE 2: NSRR Alternative

From Newtown Road to Birdneck Road, the BRT version of Alternative 2 would be the same as the LRT version. From Birdneck Road to the Oceanfront Station, the BRT version would operate in mixed traffic using existing local streets.

ALTERNATIVE 3: Hilltop Alternative

The BRT version of Alternative 3 is the same as the LRT version except that the BRT alignment would turn to the north at London Bridge Creek to connect the former NSRR ROW to Parker Lane. BRT vehicles would operate in mixed traffic on Parker Lane and Virginia Beach Boulevard through the Laskin Road interchange. The Great Neck Station would be at-grade near the location identified in the LRT-version. BRT vehicles would enter an exclusive guideway that begins at Phillip Avenue. The BRT-exclusive guideway would continue east in the median of Laskin Road until it reaches Birdneck Road. The configuration of Laskin Road including the BRT guideway would be similar to the proposed LRT configuration, including an elevated structure over First Colonial Road. At Birdneck Road, the BRT vehicles would exit the exclusive guideway and turn south on Birdneck Road. BRT would operate in mixed traffic on Birdneck Road and 19th Street until it reaches the terminal station at the Oceanfront Resort Area.

2.1.2 Stations

Station locations have been identified for the alignment alternatives under consideration. These stations would be accessible by pedestrians, buses, cars, and bicycles.

Parking would be available at many of the station sites, while others would be walk-on only. The parking locations are identified in the descriptions of the stations on the following pages.

The station boarding platforms are initially planned to accommodate one bus rapid transit vehicle or one light rail vehicle—approximately 90 feet in length. The sites identified would allow for the future expansion of the platforms for use with two-car vehicle sets.

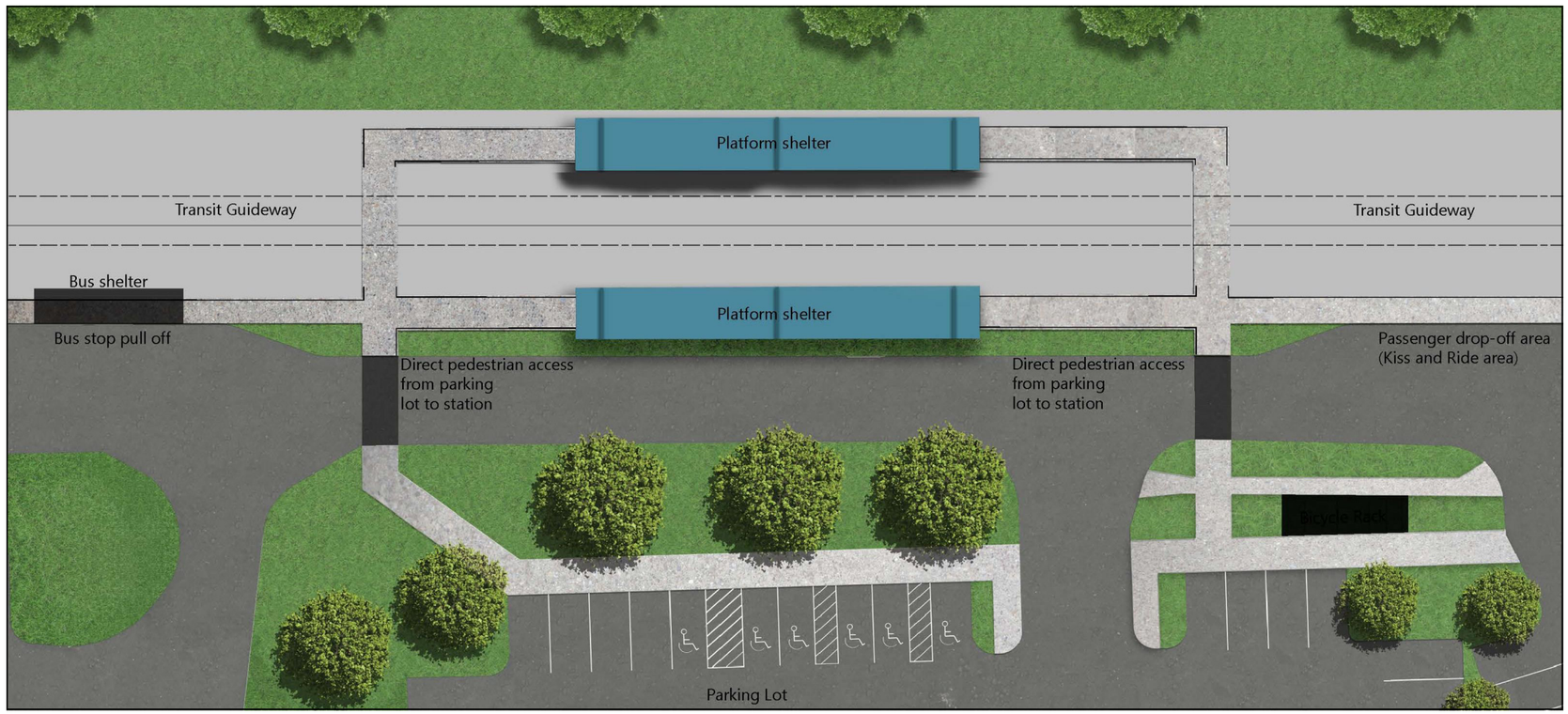
While this project is currently early in the planning and conceptual design phase, there will be typical characteristics incorporated in all stations. Station amenities for light rail and bus rapid transit stations would be similar to those currently found on The Tide. Station designs would provide accommodations for the needs of all users, including the elderly and persons with disabilities.

Standard services and amenities include:

- Vicinity map(s) (kiosk)
- Bicycle parking
- Bus service with bus shelters
- Kiss & Ride drop-off area
- Security cameras
- Emergency call-box
- Platform canopies
- Platform lighting
- Benches
- Trash receptacles
- Fare vending machines
- Artwork

An illustration of a typical station design is shown in **Figure 2.1-6**.

Figure 2.1-6 | Typical Station Platform Area



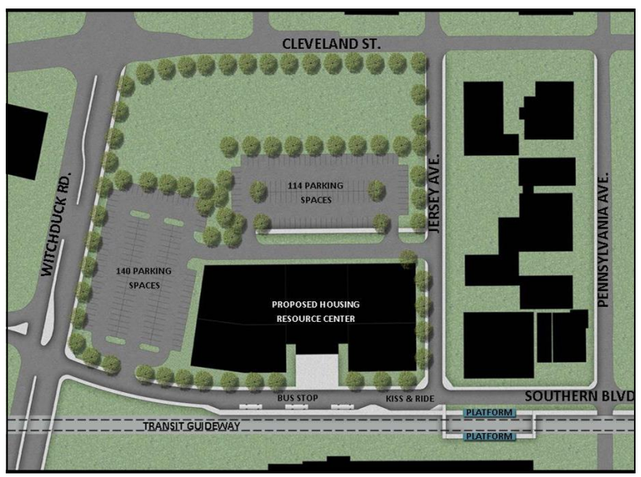
Source: HDR, 2013

Witchduck Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
✓	✓	✓	✓

The **Witchduck Station** would be located east of the intersection of Witchduck Road and Southern Boulevard. Two side platforms would be located south of Southern Boulevard within the existing former NSRR ROW approximately 750 feet east of Witchduck Road. Initial surface parking for the station would be developed and collocated in coordination with the City's planned Housing Resource Center (HRC) on the city-owned property at the northwest corner of Southern Boulevard and Jersey Avenue. HRT bus service would be provided to the station with a bus stop located on Southern Boulevard. The station area, excluding the joint surface parking area with the HRC, would be approximately 1.3 acres, see **Figure 2.1-7**.

Figure 2.1-7 | Witchduck Station



Source: HDR, 2013

Town Center Station Options

	ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
Town Center West	✓	–	–	–
Independence Boulevard	✓	✓	✓	✓
Market Street	✓	✓	✓	✓
Constitution Drive	✓	✓	✓	✓

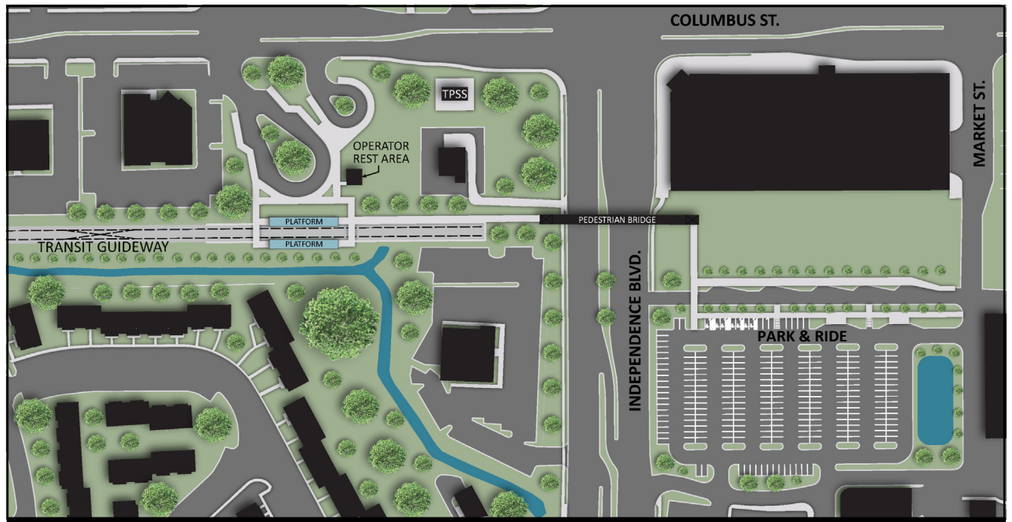
The "-" symbol denotes that the station option is not under consideration for this alternative

Four options have been identified for the **Town Center Station.** Only one of the station options would be constructed for any of the alternatives. The options are described below.

For the **Town Center Station – Town Center West Option** (**Figure 2.1-8A**), a side platform station would be located at ground level approximately 300 feet west of Independence Boulevard. Parking for the station would be located approximately 750 feet southeast of the station platform on a site owned by the City of Virginia Beach east of Independence Boulevard. An existing parking area at the City-owned lot between Independence Boulevard and Market Street would be reconstructed, and the existing commercial building on the site would be removed. The surface parking lot for this station has approximately 242 spaces. To allow pedestrian circulation between the station platform and the Park & Ride lot, a pedestrian bridge would be constructed over Independence Boulevard with elevators and stairways on both sides of the road. HRT bus service would be provided to the station, and a bus loading area would be located immediately north of the station platforms. The bus loading area would be on a site that currently has a commercial building and parking lot, both of which would be removed. The total area of development for the station, bus loading area, and parking lot would be approximately 6.8 acres.

For the **Town Center Station – Independence Boulevard Option** (**Figure 2.1-8B**), a center platform station would be located on a bridge over Independence Boulevard. Pedestrian access to the platforms would be by elevator/stairway on both sides of the boulevard. Parking for the station would be on the same site that was identified for the Town Center West Option, with approximately 242 spaces. HRT bus service would be provided to the station, and a bus loading area is included in the conceptual design adjacent to the parking area. The area of development for the station and the parking lot would be approximately 5.4 acres.

Figure 2.1-8 A-B | Town Center Station Options



A. Town Center West Option

Source: HDR, 2014

B. Independence Boulevard Option

Source: HDR, 2013

Town Center Station Options

(continued)

For the **Town Center Station – Market Street Option** (**Figure 2.1-8C**), a center platform station would be located on a bridge over Market Street. Pedestrian access to the platforms would be by elevator/stairway on both sides of Market Street. Parking for the station would be the same as for the Town Center West and Independence Boulevard Options. The station may also accommodate a connection to the existing parking garage adjacent to the right-of-way. HRT bus service would be provided to the station, and a bus loading area adjacent to the parking lot is included in the conceptual design. The area of development for the station and the parking lot would be approximately 6.2 acres.

For the **Town Center Station – Constitution Drive Option** (**Figure 2.1-8D**), a side platform station would be located at ground level along the former NSRR ROW immediately west of Constitution Drive. Parking for the station would be the same as that for the previous three station options with an at-grade pedestrian walkway of about 1,200 feet in length connecting the parking area to the station platform.

Figure 2.1-8 C-D | Town Center Station Options

C. Market Street Option

Source: HDR, 2013

D. Constitution Drive Option

Source: HDR, 2013

HRT bus service would be provided to the station, and a bus loading area adjacent to the parking lot is included in the conceptual design. The area of development for the station and the parking lot would be approximately 6.5 acres. (As part of the City of Virginia Beach's Pembroke Strategic Growth Area Plan, the City has stated that under the Constitution Drive Option, they may consider the need for a second Town Center station to serve future development on the west side of Independence Boulevard. This potential second Town Center Station was identified as a non-specific, potential future need dependent on currently unidentified growth in the area. Therefore, a second station was not considered as part of this DEIS.)

Rosemont Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	✓	✓	✓

The **Rosemont Station** (**Figure 2.1-9**) would be located east of Lynn Shores Drive along the former NSRR ROW. The site is located between Virginia Beach Boulevard and Bonney Road and currently has three large billboards that would need to be permanently removed for construction of the station's parking area. The surface Park & Ride lot would include spaces for approximately 175 cars. Two side platforms for the station would be located within the former NSRR ROW on the north side of the property. HRT bus service would be provided to the station. The area of development for the station and the parking lot is approximately 4.0 acres.

Figure 2.1-9 | Rosemont Station

Source: HDR, 2013

Lynnhaven Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	✓	✓

The **Lynnhaven Station** (**Figure 2.1-10**) would be located along the former NSRR ROW near the intersection of North Lynnhaven Road and Southern Boulevard. This station would have two side platforms. A parking area to serve the station would be located on the north side of Southern Boulevard, an area that is currently occupied by a small office building and an adjacent paved parking lot. Both the building and the existing parking lot would be removed to accommodate a Park & Ride lot with approximately 184 parking spaces. The southwest portion of the Park & Ride lot would be reserved for a proposed traction power substation (TPSS). HRT bus service would be provided to the station along Southern Boulevard. The area of development for the station and the parking lot is approximately 3.0 acres.

Figure 2.1-10 | Lynnhaven Station

Source: HDR, 2013

North Oceana Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	✓	✓

The **North Oceana Station** (**Figure 2.1-11**) would be located on Potters Road west of Air Station Drive. A surface Park & Ride lot with approximately 275 parking spaces to serve the station would be located on a City-owned parcel located north of the former NSRR ROW. This site is currently used for construction material disposal and emergency storm debris storage. The station would have two side platforms. HRT bus service would be provided to the station along Potters Road. The immediate area of development for the station and parking would be approximately 6.2 acres.

Figure 2.1-11 | North Oceana Station

Source: HDR, 2013

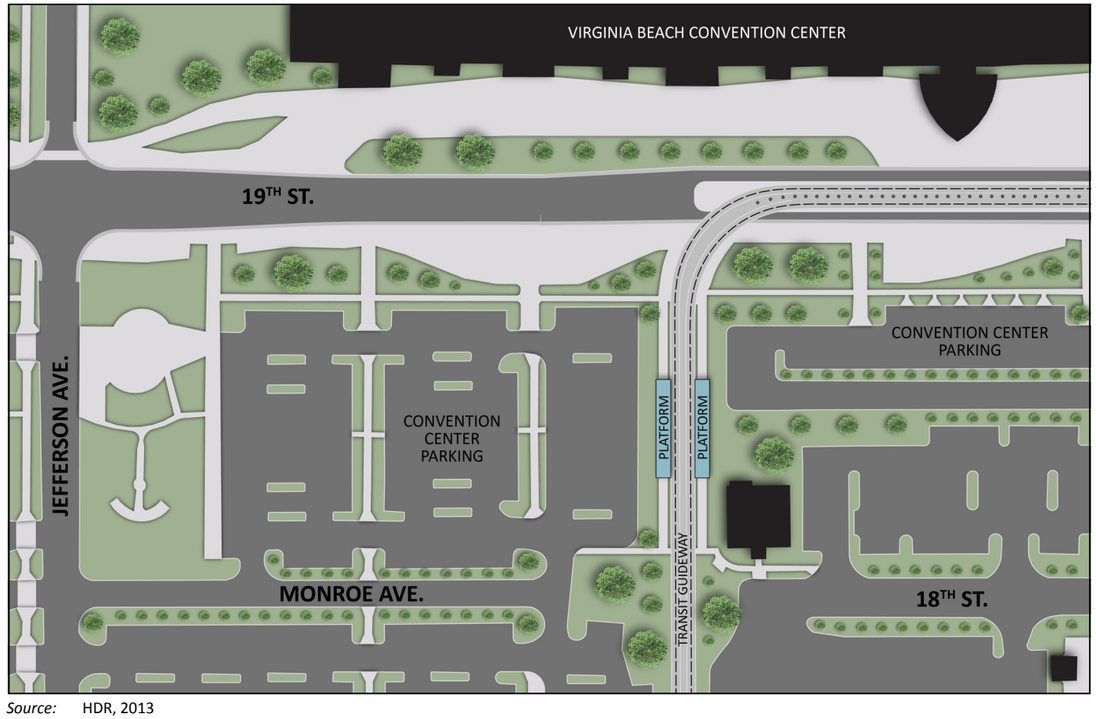
Convention Center Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	✓	✓

The proposed Virginia Beach **Convention Center Station** (**Figure 2.1-12A**) for Alternative 2 would be located on Washington Street south of 19th Street. The station would have two side platforms and sufficient space adjacent to the platforms to accommodate increased passenger traffic that would use the station for special events. There is no new Park & Ride lot associated with this station, but the existing Convention Center parking lots owned by the City of Virginia Beach could be used for transit when space is available. The design of the transit station would complement the architecture of the Virginia Beach Convention Center. Station amenities, street furniture, and landscaping would follow the material guidelines of the Virginia Beach Convention Center and the City's proposed 19th Street Corridor Improvement Plan. The construction of the station would require modification of 19th Street, adjacent parking lots, and areas of the Virginia Beach Convention Center plazas.

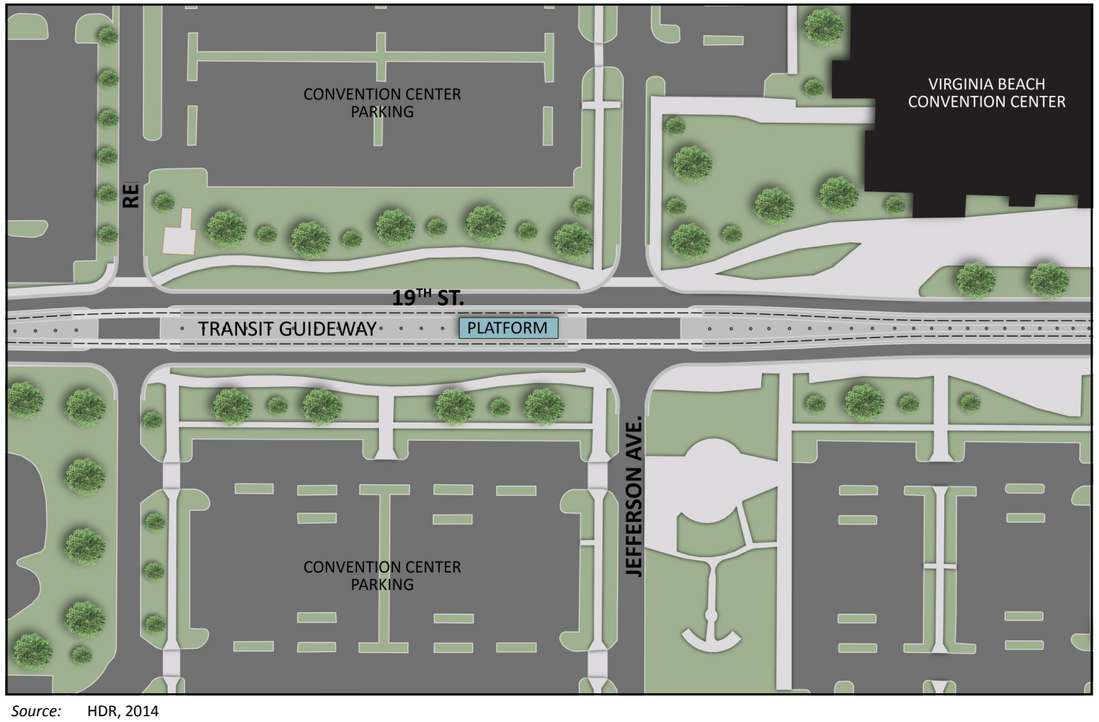
The **Convention Center Station** (**Figure 2.1-12B**) for Alternative 3 would have a center platform in 19th Street west of the Virginia Beach Convention Center. A new Park & Ride lot is not planned for this station, but adjacent Convention Center parking lots owned by the City of Virginia Beach could be used by transit patrons when space is available. The design of the transit station would complement the architecture of the Virginia Beach Convention Center. Amenities, street furniture, and landscaping would follow its material guidelines and the City's proposed 19th Street corridor improvement plan. The extent of work would include modification of 19th Street and some of the Virginia Beach Convention Center plazas and landscaping.

Figure 2.1-12A | Convention Center Station (Alternative 2)



Source: HDR, 2013

Figure 2.1-12B | Convention Center Station (Alternative 3)



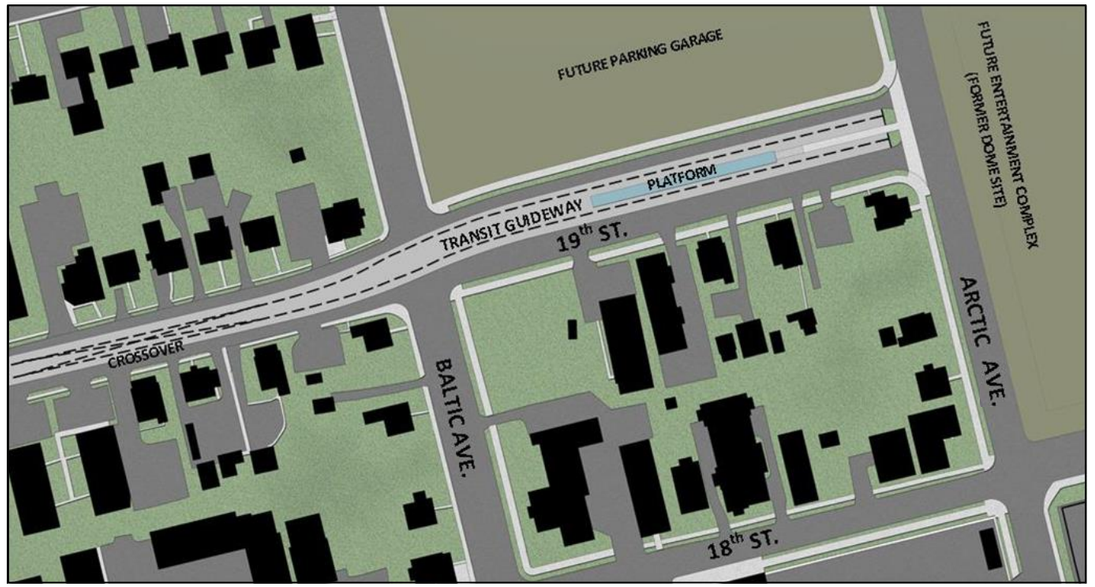
Source: HDR, 2014

Oceanfront Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	✓	✓

The eastern end-of-line **Oceanfront Station** (**Figure 2.1-13**) for the proposed NSRR Alternative is at 19th Street between Arctic and Baltic Avenues. This station would serve the Oceanfront Resort Area and future development on City-owned property in the vicinity. The Oceanfront Station would be a center platform in a new median on 19th Street. The station would be designed to accommodate high passenger loads that would be expected at this station during the summer and for special events. The station and the surrounding amenities would be coordinated with the design of the City's proposed 19th Street corridor improvement plan. Transfers to HRT bus service would be provided at nearby bus stops located in coordination with proposed developments.

Figure 2.1-13 | Oceanfront Station



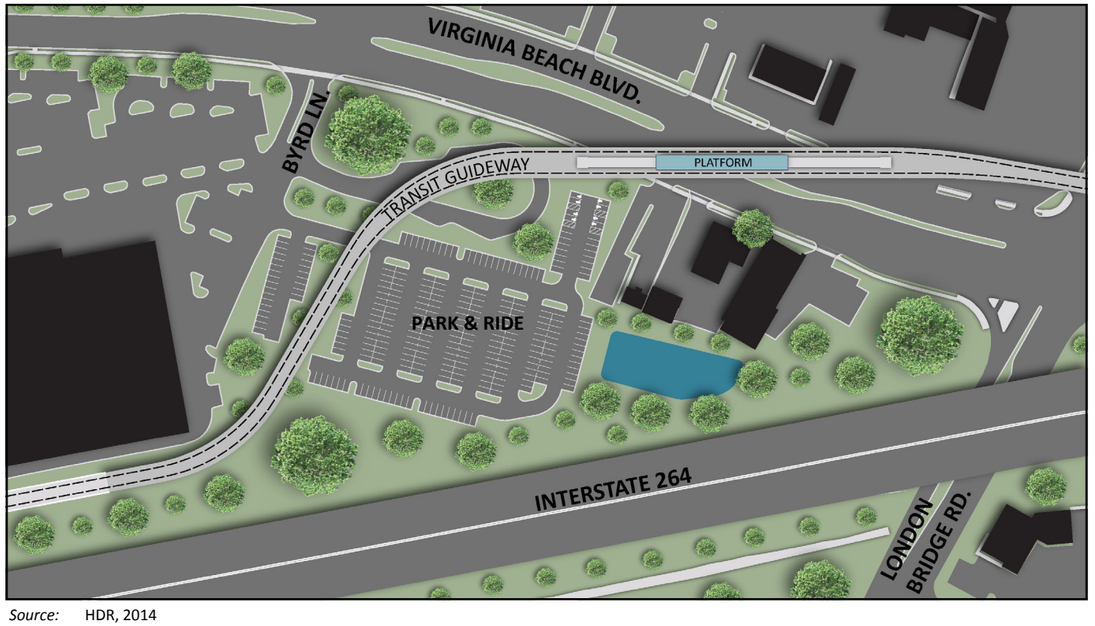
Source: HDR, 2013

Great Neck Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	–	✓

The **Great Neck Station** (**Figure 2.1-14**) would be located on an elevated structure across Virginia Beach Boulevard west of Great Neck Road. This station would have a center platform, and pedestrian access would be from elevators and stairways on both sides of Virginia Beach Boulevard. A surface Park & Ride lot with approximately 250 spaces would be provided south of the station. A bus loading area for HRT bus service is proposed adjacent to the Park & Ride. The total area of development for this station would be approximately 6.1 acres.

Figure 2.1-14 | Great Neck Station



Source: HDR, 2014

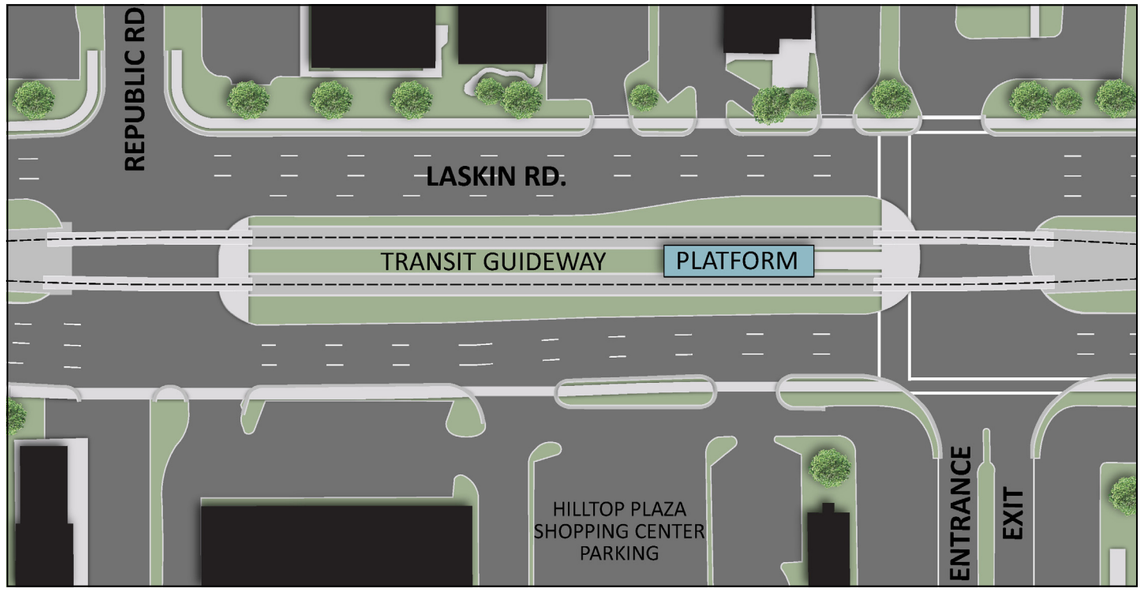
Design Note: For the BRT mode, the station would be located at-grade on Virginia Beach Boulevard. Curb modifications would be required for the level boarding platform. The Park & Ride lot would be in the location shown in Figure 2.1-14.

Hilltop West Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	–	✓

The **Hilltop West Station** (**Figure 2.1-15**) would be located at-grade in the median of Laskin Road between Republic Road and the Hilltop Plaza Shopping Center entrance. It is proposed as a center platform station with access from the intersection at the Hilltop Plaza Shopping Center entrance. This intersection would include pedestrian signal phases and crosswalks to access the station from the north and south sides of Laskin Road. This station is proposed as a pedestrian/cyclist walk/ride-up station with no designated Park & Ride lot. HRT bus service would be provided to the station with bus stops along the right curb lane of Laskin Road.

Figure 2.1-15 | Hilltop West Station



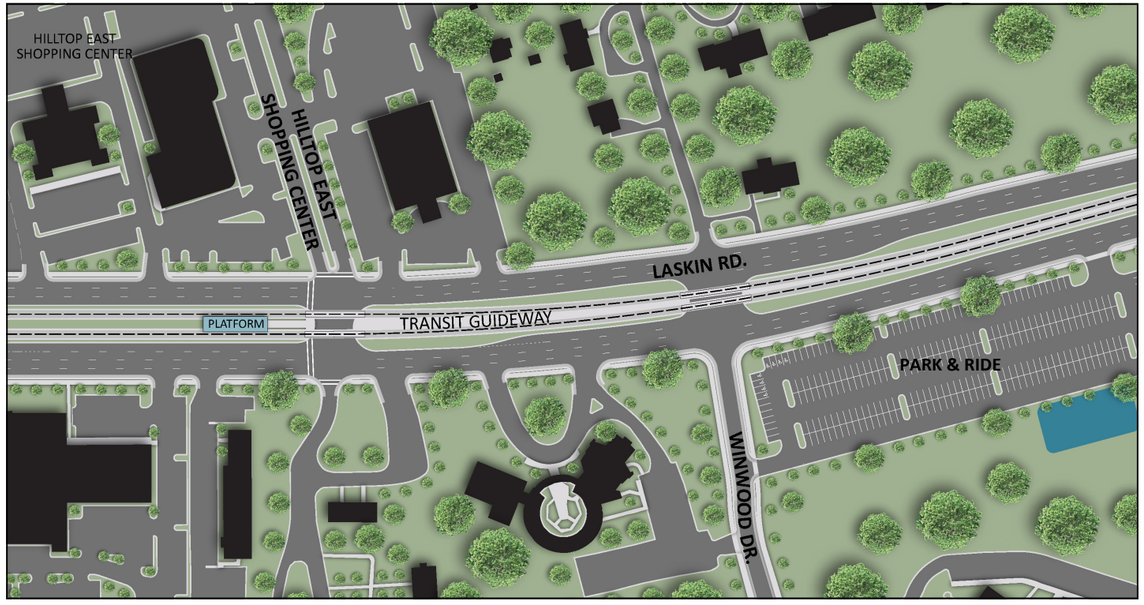
Source: HDR, 2013

Hilltop East Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	–	✓

The **Hilltop East Station (Figure 2.1-16**) would be a center platform located at-grade in the median of Laskin Road near the Hilltop East Shopping Center. A surface Park & Ride lot for this station with approximately 250 spaces is proposed on the south side of Laskin Road east of Winwood Drive. The developed area of this site is approximately 3.0 acres. The proposed Park & Ride site is approximately 650 feet east of the station platform, and a new paved sidewalk would be provided to connect the two locations. Pedestrian signal phases and crosswalks would be provided to access the station from the north and south sides of Laskin Road. HRT bus service would be provided to the station with bus stops along the right curb lane of Laskin Road.

Figure 2.1-16 | Hilltop East Station



Source: HDR, 2014

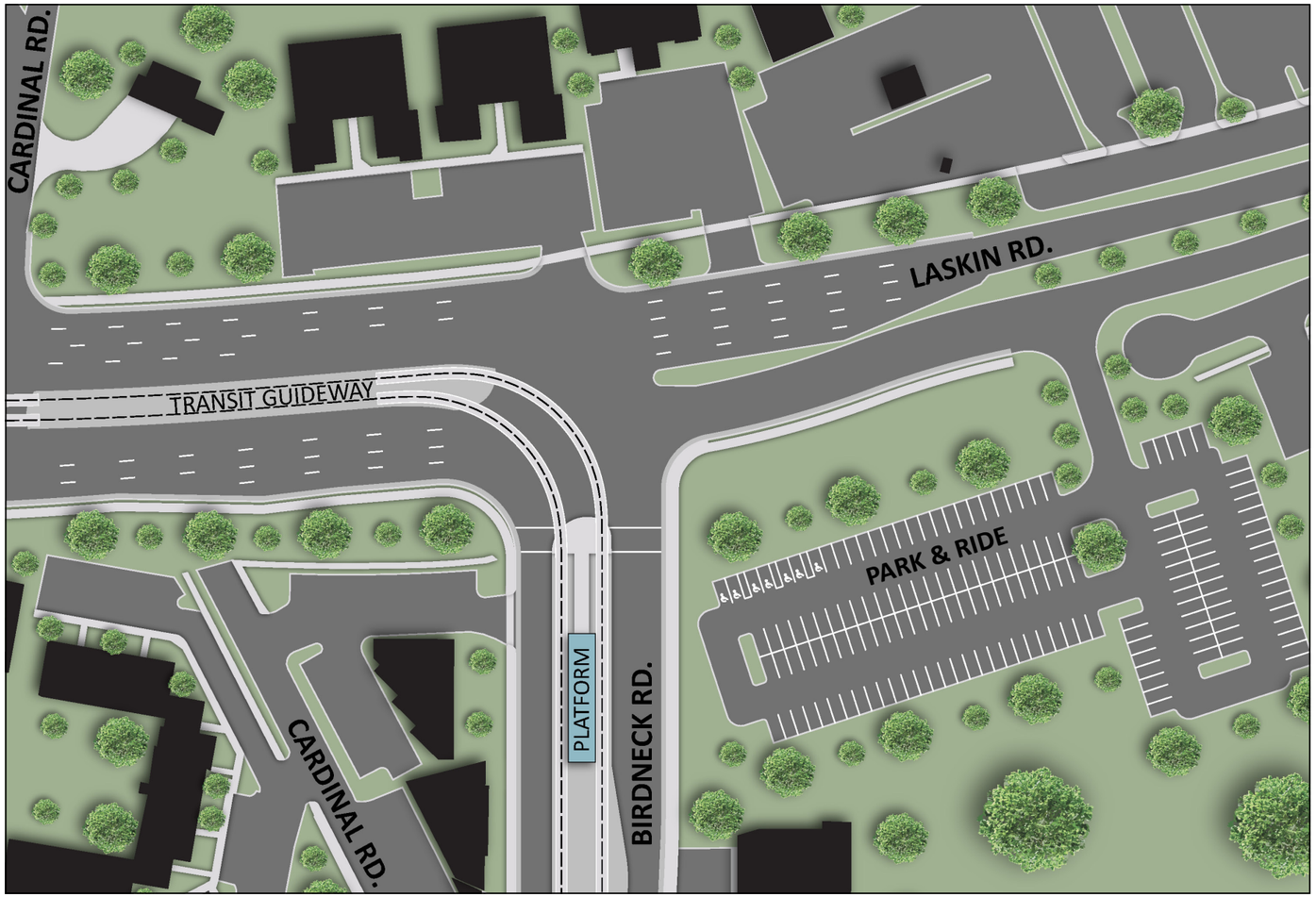
Birdneck Road Station

ALT 1A Town Center	ALT 1B Rosemont	ALT 2 NSRR	ALT 3 Hilltop
–	–	–	✓

The **Birdneck Station** (**Figure 2.1-17**) would be located on Birdneck Road immediately south of Laskin Road. It is proposed as an at-grade center platform station. Pedestrian signal phases and crosswalks would be provided at the Birdneck Road/Laskin Road intersection to access the station. A surface Park & Ride lot with approximately 150 spaces would be provided at the southeast corner of Laskin Road and Birdneck Road. The developed area for the Park & Ride site would be approximately 3.0 acres. HRT bus service would be provided with bus stops on Laskin Road near the station.

Design Note: For the BRT mode, the station would be located on-street on Birdneck Road. Curb modifications would be required to accommodate the platform. The Park & Ride lot would be in the same location as the LRT alternative.

Figure 2.1-17 | Birdneck Road Station



Source: HDR, 2014

2.1.3 System-Wide Components and Operating Characteristics

LRT System Wide Components

There are several components of an LRT system that would be common to all of the LRT alternatives. These system-wide components are presented below.

Guideway

The LRT guideway includes two tracks made of continuously welded steel rails. Each track is generally used for travel in a single direction, but crossover tracks are placed strategically to allow trains to use the other track if necessary.

The primary types of track structures are ballasted (the rails are affixed to concrete or timber cross ties that are held in place by stone ballast), embedded in a concrete slab (such as a street-running segment of the alignment), or directly affixed to concrete using special fasteners (mostly used on bridges). For the majority of Alternatives 1A, 1B, 2, and 3 along the former NSRR ROW, the LRT track section would be similar to that found on The Tide east of the NSU Station. This section consists of two ballasted tracks and ditches on each side to drain water away from the ballast.

Figure 2.1-18 shows a typical ballasted track section in the former NSRR ROW. The placement of the LRT tracks within the ROW is restricted by the presence of Dominion Virginia Power transmission lines; specifically, when the tracks are at-grade, the nearest rail cannot be within 12 feet of a transmission tower. The transmission lines are located primarily on the southern edge of the former NSRR ROW and run parallel to the existing rail infrastructure. In some areas, the transmission lines cross the ROW and run on the north side of the alignment. The National Electric Safety Code (NESC) also restricts the distance between the transmission lines and the overhead lines that provide power to light rail vehicles, as well as the distance between the transmission lines and other structures such as bridges crossing over major roadways. In order to avoid relocating the transmission lines and maintain the required minimum distances, the LRT alignments would have to shift to the north whenever they are elevated in areas where the transmission lines run to the south.

The LRT guideway would be semi-exclusive with crossings for vehicles, bikes, and pedestrians only at designated locations. In many areas along the former NSRR ROW an access road would be provided along the tracks for use by maintenance vehicles and emergency vehicles where there is not a road nearby. The access road is proposed to be gravel and approximately 14 feet wide. If the City were to construct a shared-use path adjacent to the transit guideway as proposed in the 2011 *Bikeways and Trails Plan* (see **Section 3.4.1**), that path could potentially be used by maintenance and emergency vehicles. Fences would be installed in various locations along the guideway to discourage pedestrians from walking on the tracks and crossing the tracks at non-designated areas. These locations would be determined during future phases of design.

Where right-of-way widths are constrained, the ballasted track can be retained using concrete ballast curbs or gravity walls. Drainage would be provided using underdrains connected to a stormwater system.

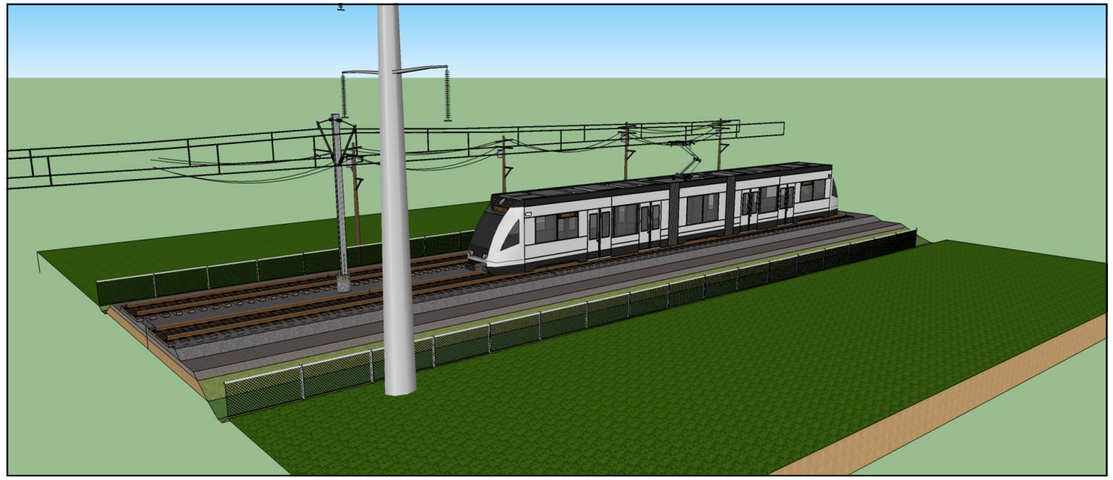
Embedded tracks (as shown in **Figure 2.1-19**) would be used in low-speed areas where an open style of track (such as ballast) is not desired. Embedded track is proposed to be used along Birdneck Road in Alternative 3 and 19th Street in Alternatives 2 and 3. Shared lanes with LRT and rubber-tired vehicles are not proposed under any of the LRT alternatives. Where embedded tracks are proposed, the LRT guideway would be delineated using pavement markings, curbs, or other physical devices.

Light Rail Transit Vehicles (LRV)

All of the LRT alternatives would utilize the same (or similar) type of vehicle that is used for HRT's existing light rail service (see **Figure 2.1-20**). Currently HRT uses the Siemens S70 light rail vehicle (LRV). The LRT alternatives would be an extension of The Tide, and vehicles from the existing fleet along with any new vehicles would be used to provide service for the entire system in Norfolk and Virginia Beach.

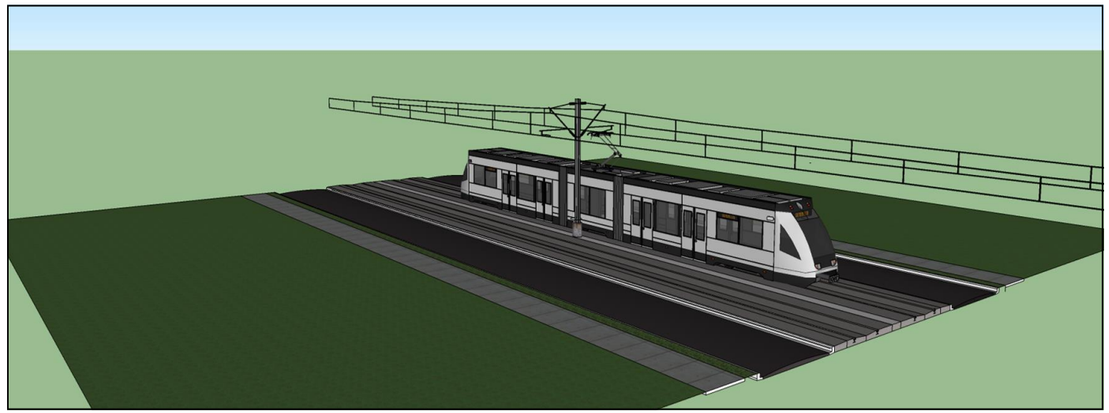
The current and proposed LRV are a 70% low-floor design; the vehicles are accessed from low-level platforms (approximately 14 inches above the top of rail) without steps between the entrances and part of the passenger cabin. Stations would have low-level platforms meeting all Americans with Disabilities Act (ADA) requirements. The

Figure 2.1-18 | Ballasted Track Section (along former NSRR ROW)



Source: HDR, 2013

Figure 2.1-19 | Embedded Track Section (19th Street)



Source: HDR, 2013

Figure 2.1-20 | Light Rail Vehicle

Source: Hampton Roads Transit, 2013

vehicles are powered by electricity delivered through an overhead wire. The vehicles are currently operated as single units, but they have the capability to be coupled and function as a multiple-unit train. The vehicles are bi-directional (they do not need to turn around at the end-of-line) and have a maximum capacity of approximately 150 passengers (72 seated).

Due to the number of vehicles required to run the planned service for the LRT alternatives, new light rail vehicles (LRV) would be required to supplement the existing fleet. **Table 2.1-3B** shows the number of new vehicles (including spares) required for each alternative.

Fare Collection and Passenger Information Systems

Fare collection for the LRT alternatives is assumed to be provided through off-vehicle payment using ticket vending machines and a proof-of-payment system as currently used on The Tide. Passenger information signage would be provided at each platform, and safety and security features at all stations include adequate lighting, emergency call boxes, and security cameras. The LRT build alternatives would also include a communications system backbone.

Traction Power System

The LRT vehicles would be powered by an overhead contact system (OCS). The system would include support structures and overhead wires for supplying electrical power to the vehicles. The support structures for the OCS system would include single poles with cantilevered bracket arms or multiple poles on either side of the tracks with support wires strung across the tracks from which the contact wire would be suspended. Typically, for straight segments of track, support poles would be required about every 80 to 100 feet. For curved segments, more frequent pole spacing would be needed.

Traction power substations (TPSS) would be used to provide electrical power to the OCS to power the LRT vehicles. TPSS do not generate electricity; rather, they convert existing electrical current to an appropriate type and level – in this case, 750 volts DC. TPSS would be located between one- and two-mile intervals along the LRT alternative alignments to maintain electrical power to the traction networks and to the passenger stations. TPSS sites are selected to meet a balance of safety, reliability, cost, and operational efficiency needs. The TPSS sites would be approximately 60 by 80 feet, and they would be designed to minimize impacts to surrounding properties. The specific locations of TPSS sites are shown in the conceptual engineering drawings (**Appendix G**). The actual site locations are subject to change during Preliminary Engineering and Final Design. **Figure 2.1-21** is a picture of an existing TPSS for The Tide at the Newtown Road Station. This figure shows an architecturally enhanced substation that was used in the areas of greater visibility along The Tide's alignment. Prefabricated metal TPSS enclosures would be used in locations where appearance is not critical.

The methods of controlling traffic at light rail crossings would vary depending on the crossing location. Where LRT alignments would cross public streets at-grade, devices such as railroad-style flashing lights, gates, and conventional traffic signals would be used to control traffic. In low-speed areas and where the LRT would operate in the median of a roadway, traffic signals would be used for controlling both LRT and road vehicles, sometimes in conjunction with flashing lights and gates. Where appropriate, pedestrian signals, signs, and/or channelized crossings with fences would be provided. All warning devices, traffic signals, signs, and pavement markings would be in conformance with the current version of the *Manual on Uniform Traffic Control Devices* (MUTCD) and City of Virginia Beach standards.

In areas where the LRT would operate at higher speeds, such as on the former NSRR ROW, light rail vehicles would be controlled using train signals and monitored from an operations control center. The train control system includes circuits on the tracks, signal and power cables, and wayside signal bungalows. Signal bungalows are small buildings that contain equipment used to operate the train control system. They need to be placed near railroad signals at grade crossings, at turnouts and crossovers, and elsewhere along the track alignment depending on the signal system's design. The signal bungalow locations have not been identified at this stage of the project. **Figure 2.1-22** is a picture of a typical signal bungalow used for The Tide.

Figure 2.1-21 | Traction Power Substation

Source: HDR, 2013

Figure 2.1-22 | Signal Bungalow

Source: HDR, 2013

LRT Operating Plan

The operating plan for all of the alternatives would be consistent with the 2013 summer schedule of The Tide as shown in **Table 2.1-1**. The operating plan would be modified to accommodate special event situations at the Virginia Beach Convention Center, Oceanfront Resort Area, or elsewhere as is currently done for The Tide and HRT bus service.

Average station dwell times (i.e., time to allow passengers to board and alight the transit vehicle) for the build alternatives are assumed to be 20 seconds at all stations. All LRT vehicles are assumed to stop at all stations.

Route service plans would include time for end-of-line layovers. Layovers would provide sufficient time for drivers to take required breaks as well as provide for schedule recovery (i.e., a late train can "catch up" to its schedule). Rail service plans would also reflect time to change cab controls at the end-of-line stations.

Vehicle Storage Maintenance Facility

The existing vehicle storage and maintenance facility (VSMF) for The Tide accommodates the existing nine vehicle fleet with capacity for five additional vehicles. Based on the proposed LRT service plan, the existing maintenance facility can serve any LRT extension east to the Town Center or Rosemont Stations using its current capacity (Alternatives 1A and 1B). Either of the alternatives extending The Tide to the Oceanfront Resort Area (Alternatives 2 and 3) would require a new VSMF to be constructed.

It is assumed that the new facility (proposed only under Alternatives 2 and 3) would become the primary location for light rail operations, including operator dispatching, administrative functions, vehicle maintenance, and an expanded operations control center to accommodate the larger system. The proposed VSMF would be used for LRT vehicle maintenance and running repairs, as well as a storage area for vehicles that are not in service. LRT vehicles would be cleaned on a daily basis, and spot repairs would be performed as necessary. The vehicles would also be serviced according to a fixed inspection and maintenance schedule to help ensure operational safety and reliability. The proposed facility is anticipated to be a heavy maintenance and storage area with capacity for approximately 38 operational and spare light rail vehicles which would allow for future growth in the system. Features of the new VSMF would include:

- Storage yard for the LRV fleet and other HRT vehicles;
- Train make-up and yard dispatch;
- Circulation and lead tracks;
- Service and inspection shops;
- Heavy repair areas including component rebuilding; paint shop, and body repair;
- Vehicle car wash;
- Support facilities, including parts storage, building mechanical and electrical space, administration and records offices, employee locker and washrooms, conference and training rooms, and operator rest areas;
- Parking for employees and visitors; and
- An expanded operations control center.

Under Alternatives 2 and 3, HRT's existing maintenance facility would continue to be used for vehicle storage with limited maintenance functions. With the two facilities combined, HRT would be able to perform a wider range of maintenance activities beyond what can be currently done at The Tide's only existing VSMF, such as paint and body repair.

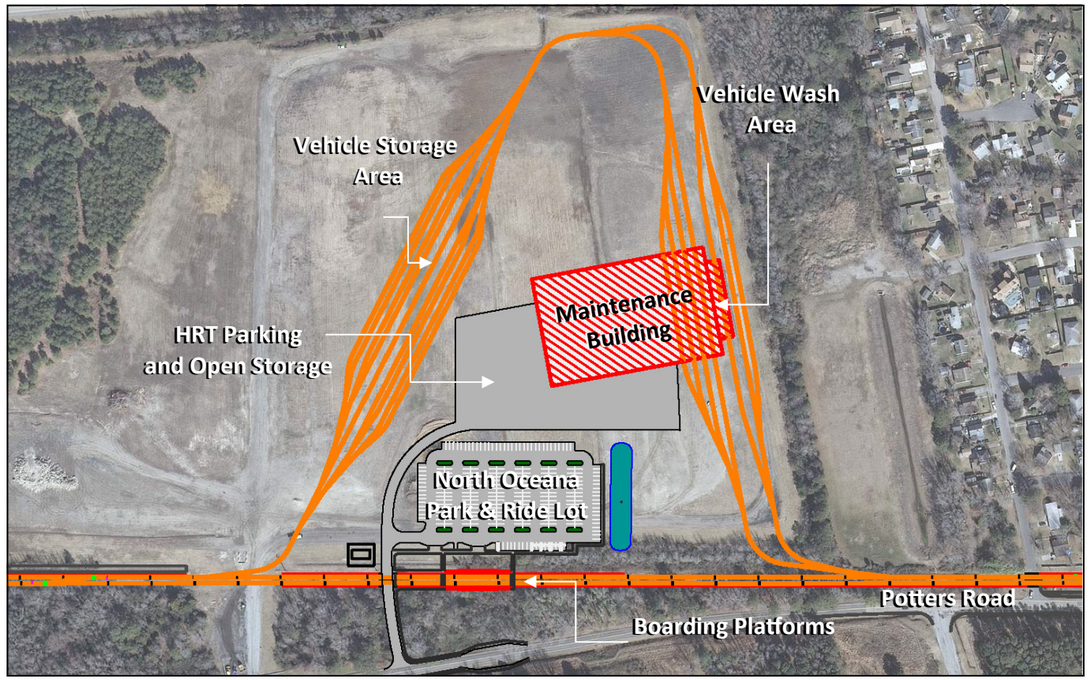
The proposed VSMF site is located on property owned by the City of Virginia Beach north of Potters Road between London Bridge Road and First Colonial Road. The site's prior uses were as a borrow pit for construction of what is now I-264 then as a landfill for dredged material and temporary storage of storm debris and other materials. This site is approximately 40 acres with sufficient space for initial operations and room for expansion of the LRT system. Roadway access would be available from Potters Road; the access road into the site would need to cross Navy-owned or VDOT-owned property. The surrounding land is vacant (see **Figure 2.1-23**).

Table 2.1-1 | Fixed Guideway Operations Plan (All LRT and BRT Alternatives)

Span of Service				Service Frequency (minutes)		
Period	Weekday	Saturday	Sunday	Weekday	Saturday	Sunday
Peak	6:30am-9am, 3:30-7pm	9am-9:30pm	10:55am-9pm	10	15	15
Base	6am-6:30am, 9am-3:30pm, 7pm-10pm	6am-9am		15	30	
Late Night	10pm-11pm (10-12am Friday Only)	9:30pm-12am	n/a	30	30	n/a

Source: Hampton Roads Transit, 2013

Figure 2.1-23 | Light Rail Storage and Maintenance Facility (Alternatives 2 and 3)



Source: HDR, 2014

Capital Costs

Design and construction of the LRT build alternatives (escalated to the year 2018, as the assumed midpoint of construction) would have capital costs as shown in the LRT Alternative Summary **Table 2.1-3B**. Additional detail on the cost estimates is attached in **Appendix H**.

Operation and Maintenance Costs

Operating and maintenance costs have been forecasted for each of the LRT alternatives using FTA-approved methodologies. Operation and maintenance costs of the LRT build alternatives are shown in **Table 2.1-3B**.

Ridership Forecasts

Ridership forecasts for the Virginia Beach Transit Extension Study were developed using the current HRT-customized version of the Hampton Roads Regional Travel Demand Model. The model was originally developed by the Virginia Department of Transportation (VDOT) for the Hampton Roads Transportation Planning Organization (HRTPO). Significant enhancements were made by Hampton Roads Transit to incorporate Federal Transit Administration suggestions and requirements. Forecasts are presented for the year 2034.

Ridership projections for the LRT alternatives are presented in **Table 2.1-3B** and discussed further in **Section 3.2**.

Bus Feeder System

HRT currently operates local and express fixed route bus service along designated routes through the VBTES Corridor. As part of the build alternatives, this HRT bus system would be modified to improve access to the proposed stations. The modified bus service, or bus feeder system, would include increases in bus frequencies, stops at the new LRT stations, and in some cases, modification of bus route alignments to enhance local connectivity. All other routes in the VBTES Corridor would have expanded hours of service to match the build alternative's operations plan.

Descriptions of routes with revised coverage are shown in **Table 2.1-2**, and the new routes are shown in **Figures 2.1-24A-C**.

BRT System Wide Components

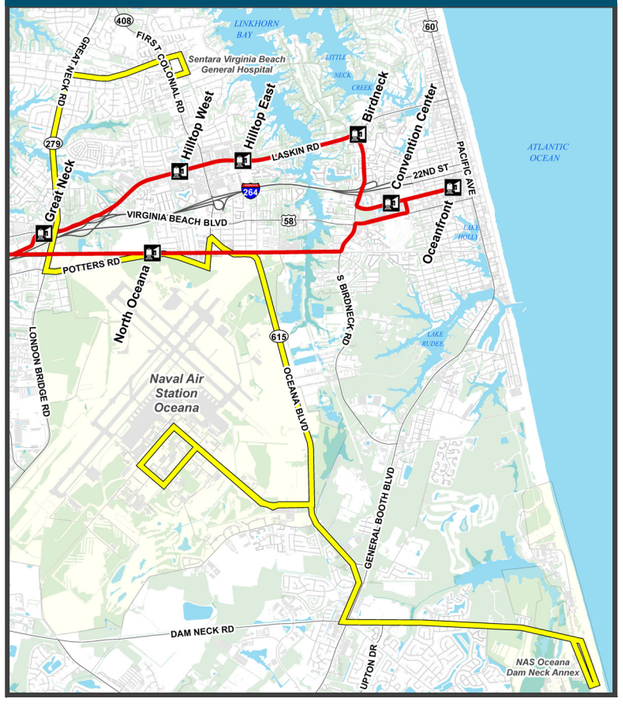
There are several components of a BRT system that would be common to all of the BRT alternatives. These system-wide components are presented below.

Guideway

Where the BRT would operate in an exclusive or semi-exclusive guideway, such as on the former NSRR ROW, the guideway consists of a paved road designed for the loads associated with the buses that would use it. In higher speed sections of the alignment, the two directions of travel would be separated by barriers, and paved shoulders would be provided. Barriers would also be located along the outside

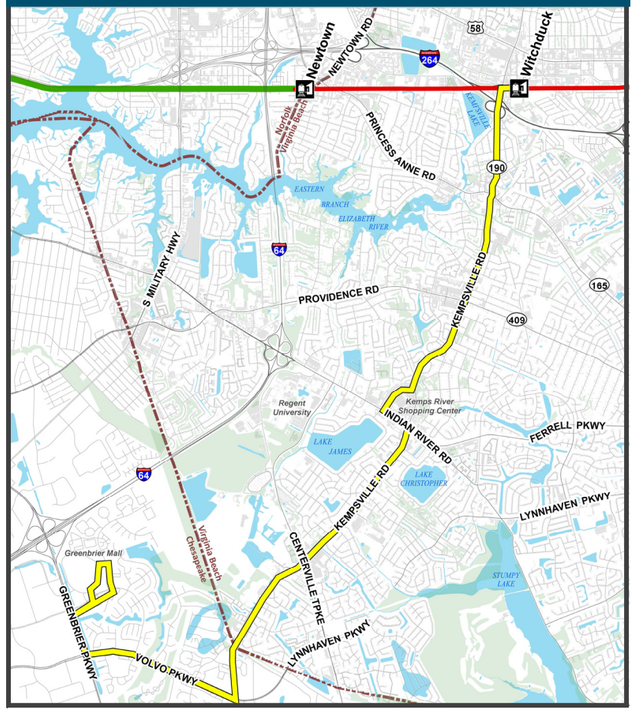
Figure 2.1-24 A-C | New Feeder Bus Routes

A: Route 35



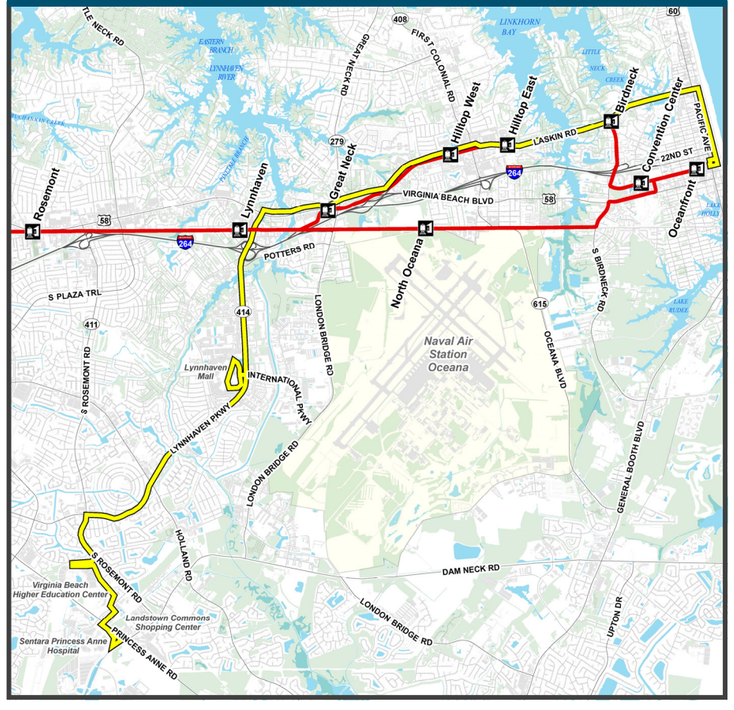
Source: HDR, 2014

B: Route 38



Source: HDR, 2014

C: Route 39



Source: HDR, 2014

Table 2.1-2 | Revised Bus Routes and New Feeder Routes in VBTES Corridor

Route	Span of Service			Service Frequency			Changes from Existing Service
	Weekday*	Saturday	Sunday	Weekday	Saturday	Sunday	
Route 1	4:43am-9am,3pm-6pm 9am-3pm,6pm-10pm 10pm-1:37am	4:39am-1:29am	5:37am-1:31am	15 30 60	30	30	The route would be split at Pleasure House Road/Shore Drive with extension of Route 36.
Route 10	4pm-6:30pm 10am-4pm,6:30pm-10pm 10pm-12:20am(1:20am Fri)	10am-1:20am	11am-10:20pm	30 60 60	60	60	New route replaces northern portion of Route 33.
Route 26	5:15am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-11:55pm(12:55am Fri)	5:45am-12:55am	10:45am-9:55pm	30 60 60	60	60	Route 26 would be reconfigured to provide a new service between Sentara Princess Anne Hospital, TCC, and Virginia Beach Town Center via the Constitution Drive extension, Bonney Road, and Rosemont Road.
Route 28	5:15am-9am,4pm-6:51pm n/a n/a	n/a	n/a	15 n/a n/a	n/a	n/a	Limited stop service along Virginia Beach Boulevard between Town Center Station (Alternative 1A) or Rosemont Station (Alternative 1B) and the Virginia Beach Oceanfront Resort Area, serving as a feeder route for Alternatives 1A and 1B only.
Route 29	4:45am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-12:15am(1:15am Fri)	5:15am-1:15am	10:15am-10:15pm	30 60 60	60	60	The route would be split at Hilltop at the intersection of Laskin Road and First Colonial Road for Alternatives 1A, 1B, and 2. The route would continue on Laskin Road and terminate at the Birdneck Station for Alternative 3.
VB Wave 31*	8am - 2am	8am - 2am	8am - 2am	20	20	20	The existing route connects the southern end of the Oceanfront Resort Area at Rudee Inlet to the Virginia Aquarium and Marine Science Center and the KOA Campground. The route would be extended north to 19th Street and Pacific Avenue for Alternatives 2 and 3 only.
VB Wave 32*	8am - 2am	8am - 2am	8am - 2am	20	20	20	Replaced with all day service by the new Route 39.
Route 33	4:30am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-12:30am(1:30am Fri)	5:00am-1:30am	10:00am-10:30pm	30 60 60	60	60	The route would be shifted by moving the southern end-of-line from TCC to the Virginia Beach Municipal Center (VBMC) via Nimmo Parkway. and a northern end-of-line would terminate at the 19th Street and Pacific Avenue transfer center. Alignment to Fort Story would become a new Route #10.
Route 36	5:00am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-11:35pm(12:35am Fri)	5:30am-12:35am	10:30am-9:35pm	30 60 60	60	60	Due to substantial forecasted employment activity near the VBMC, Route 36 would be extended north up to Pleasure House Road/Shore Drive and south serving Sentara Princess Anne Hospital and terminating at TCC.
Route 960 MAX							Discontinued with Build Alternatives.
Route 35	4:45am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-12:20am(1:20am Fri)	5:30am-1:20am	10:30am-10:20pm	30 60 60	60	60	New Feeder Route. Service between NAS Oceana and Virginia Beach General Hospital via Oceana Boulevard, First Colonial Road, Potters Road, London Bridge Road, North Great Neck Road, and Old Donation Parkway. For Alternatives 2 and 3 only.
Route 38	4:45am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-12:10am(1:10am Fri)	5:30am-1:10am	10:30am-10:10pm	30 60 60	60	60	New Feeder Route. Service between Greenbrier Mall transfer center and Witchduck Station via Volvo Parkway, Kempsville Road and Witchduck Road.
Route 39	5:00am-9am,4pm-6:30pm 9am-4pm,6:30pm-10pm 10pm-12:10am(1:10am Fri)	5:30am-1:10am	10:30am-10:10pm	30 60 60	60	60	New route replaces southern portion of Route 29 and Route 32 (VB Wave) seasonal service to provide all-day service between the Virginia Beach Oceanfront Resort Area and the Lynnhaven Parkway corridor. The route extended to serve Sentara Princess Anne Hospital.

Source: HDR, 2014 ** VB Wave routes operate seasonally from May 1st through Labor Day weekend .*

Table 2.1-3A | Summary of LRT Alternatives

	ALTERNATIVE 1A: Newtown Road to Town Center	**ALTERNATIVE 1B:** Newtown Road to Rosemont	**ALTERNATIVE 2:** Newtown Road to Oceanfront via the NSRR ROW	**ALTERNATIVE 3:** Newtown Road to Oceanfront via Laskin Road
Length (miles)	**3.0**	**4.8**	**12.2**	**13.5**
Grade Separations (LRT over Street)	• Witchduck Road • Independence Boulevard (if Independence, Market, or Constitution Station Option is selected)	• Witchduck Road • Independence Boulevard	• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • London Bridge Road	• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • Virginia Beach Blvd./Great Neck Rd./Laskin Rd. • First Colonial Road
Bridges over Water	• None	• Thalia Creek	• Thalia Creek • London Bridge Creek	• Thalia Creek • London Bridge Creek • Linkhorn Bay
Road Closures (Streets to be closed at LRT crossing)	• None	• Budding Avenue • Fir Avenue	• Budding Avenue • Fir Avenue	• Budding Avenue • Fir Avenue
Stations	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) — 4 site options	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) — 3 site options • Rosemont (with Park and Ride)	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) — 3 site options • Rosemont (with Park and Ride) • Lynnhaven (with Park and Ride) • North Oceana (with Park and Ride) • Convention Center • Oceanfront	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) — 3 site options • Rosemont (with Park and Ride) • Lynnhaven (with Park and Ride) • Great Neck (with Park and Ride) elevated station • Hilltop West • Hilltop East (with Park and Ride) • Birdneck (with Park and Ride) • Convention Center • Oceanfront

Source: HDR, 2014

Table 2.1-3B | Summary of LRT Alternatives

	ALTERNATIVE 1A: Newtown Road to Town Center	**ALTERNATIVE 1B:** Newtown Road to Rosemont	**ALTERNATIVE 2:** Newtown Road to Oceanfront via the NSRR ROW	**ALTERNATIVE 3:** Newtown Road to Oceanfront via Laskin Road
Length (miles)	**3.0**	**4.8**	**12.2**	**13.5**
Additional Vehicles	4 LRT Vehicles 12 Feeder Buses to Support LRT Service	5 LRT Vehicles 10 Feeder Buses to Support LRT Service	10 LRT Vehicles 11 Feeder Buses to Support LRT Service	10 LRT Vehicles 11 Feeder Buses to Support LRT Service
Storage and Maintenance Facility	Existing Tide Maintenance Facility	Existing Tide Maintenance Facility	Potters Road Site	Potters Road Site
Capital Cost				
• Current Year Dollars (2013)	Town Center West: **$240 M*** Independence/Market/Constitution: **$279 M*** ($27.7 M real estate already owned by City)	**$374 M*** ($34.5 M real estate already owned by City)	**$828 M*** ($58.1 M real estate already owned by City)	**$1,077 M*** ($55.4 M real estate already owned by City)
• Year of Expenditure (~2018)	Town Center West: **$279 M*** Independence/Market/Constitution: **$327 M*** ($30.5 M real estate already owned by City)	**$436 M*** ($37.3 M real estate already owned by City)	**$967 M*** ($61.2 M real estate already owned by City)	**$1,255 M*** ($59.3 M real estate already owned by City)
Operations and Maintenance (O&M) Costs				
• Estimated Cost to Operate and Maintain LRT Extension (2014 Dollars)	**$2.2 M** Local Share: $1.3 M	**$3.3 M** Local Share: $2.0 M	**$10.6 M** Local Share: $6.2 M	**$10.9 M** Local Share: $6.4 M
• Estimated Cost to Operate and Maintain Local Bus and Wave Services, including New Feeder Routes, in Virginia Beach (2014 Dollars)	**$18.6 M** Local Share: $7.1 M *(Increase of $3.1 M over FY 14 Budget)*	**$18.4 M** Local Share: $7.0 M *(Increase of $3.0 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*
Ridership Forecast				
• Average Weekday Boardings (Forecast Year 2034)	**2,250 LRT Stations in Virginia Beach** 7,050 LRT Stations in Norfolk 9,300 Total System	**3,370 LRT Stations in Virginia Beach** 7,180 LRT Stations in Norfolk 10,550 Total System	**5,295 LRT Stations in Virginia Beach** 7,535 LRT Stations in Norfolk 12,830 Total System	**8,845 LRT Stations in Virginia Beach** 7,820 LRT Stations in Norfolk 16,665 Total System
• Annualized Ridership (Forecast Year 2034)	2,838,000	3,219,000	3,915,000	5,085,000
• Annualized Ridership w/ Visitor Boardings (2034)	2,940,000	3,321,000	4,255,000	5,425,000

Source: HDR, 2014

** Costs rounded to nearest $1 million.*

*** Current Virginia Beach Bus Service = $10.5M in 2012 with a Local Share of $4.0M*

Norfolk System Costs = $ 34.5 M Total / $ 14.2 M Local Share (2012)

Norfolk Bus Costs = $ 22.8 M Total / $ 8.5 M Local Share (2012)

Norfolk LRT Costs = $ 11.7 M Total / $ 5.7 M Local Share (2012)

edge of the BRT guideway where drainage ditches are present. In areas where the BRT would operate at lower speeds, such as at stations or in the exclusive guideway in the median of Laskin Road (for Alternative 3), the barriers may be replaced with curbs or other traffic control devices.

Figure 2.1-25 shows a proposed typical BRT guideway in the former NSRR ROW. Because the BRT system would operate similar to a road and without any OCS infrastructure, it has greater flexibility for placing the guideway within the right-of-way relative to the Dominion Virginia Power transmission lines. Grade separated crossings over major roads would remain subject to the NESC clearance requirements, which would result in shifting the alignment to the north at those locations. The BRT system would still need to be located so as not to interfere with access to maintain the utility lines.

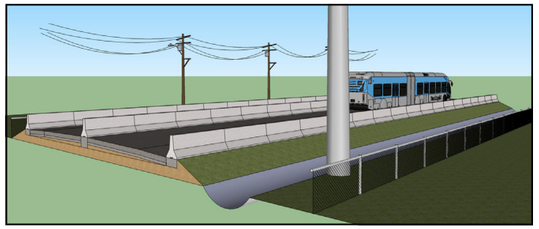
Portions of the BRT system may be located on existing streets without dedicated lanes or other special treatment for BRT vehicles. BRT vehicles are capable of operating in mixed traffic as standard transit buses do.

Bus Rapid Transit Vehicles

The BRT alternatives would operate using high-capacity 60-foot articulated buses, transit signal priority at selected intersections, and passenger stations similar to those found on an LRT system. The BRT vehicle is larger than a standard city bus. Depending on the seating configuration of the bus, the vehicle can carry a maximum load of 100 seated and standing passengers. Unlike light rail trains, BRT vehicles can not be joined to increase capacity; instead, additional vehicles and/or higher service frequencies would be required. The vehicles used for the BRT alternatives would be similar to what is shown in **Figure 2.1-26**. The BRT vehicles are of low-floor design, without steps between the doors and passenger cabin, and the station platforms would be coordinated with the vehicle design to allow for level boarding without the use of on-board ramps or bridge plates. It is assumed that vehicles selected for a BRT alternative would be powered by diesel fuel.

Should the BRT modal alternative be selected as the LPA, the use of other types of buses such as the standard 40-foot bus may be considered during future design phases of the project.

Figure 2.1-25 | BRT Guideway (along former NSRR ROW)



Source: HDR, 2013

Figure 2.1-26 | BRT Vehicle

Source: Hampton Roads Transit, 2010

Fare Collection and Passenger Information Systems

Fare collection for the BRT alternatives, like the LRT alternatives, is assumed to be provided through off-vehicle payment using ticket vending machines and a "proof-of-payment" system. Passenger information signage would be provided at each platform, and safety and security features at all stations would include adequate lighting, emergency call boxes, and security cameras. These would be linked back to HRT's operations control center through a communications system that would be constructed as part of the BRT alternatives.

Traffic and Bus Controls

Where the BRT would cross public streets at-grade at high speeds, active warning devices such as railroad-type flashers and crossing gates may be used to supplement standard traffic signals at each location. In low-speed zones, standard traffic signals would be used to control traffic at grade crossings. When operating in mixed traffic, BRT vehicles would follow traffic signals and other devices as any other vehicle on the roadway. All warning devices, traffic signals, signs, and pavement markings would be in conformance with the current version of the *Manual on Uniform Traffic Control Devices* (MUTCD) and City of Virginia Beach standards.

BRT Operating Plan

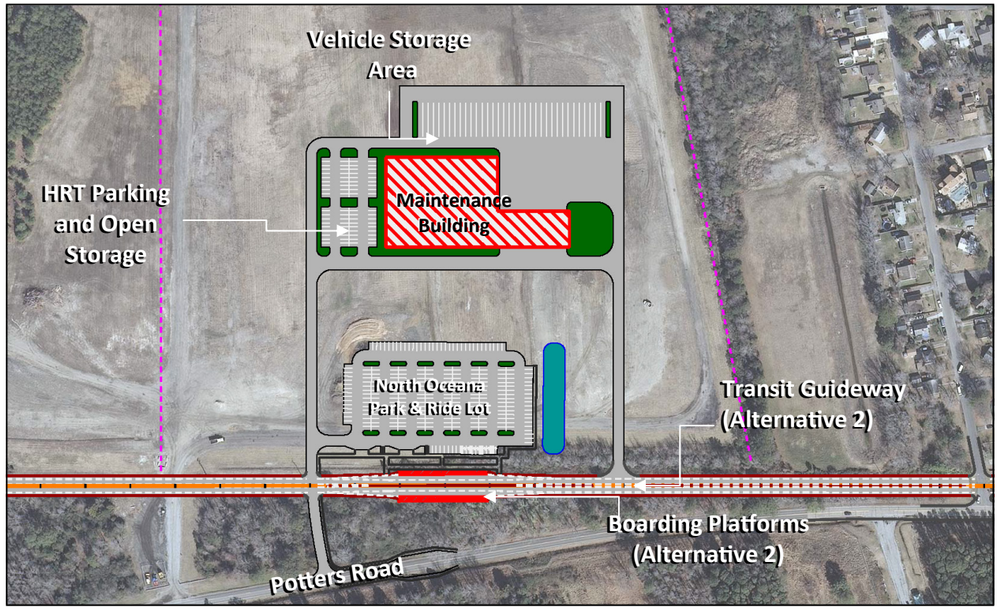
The operating plan for the BRT alternatives would be consistent with the LRT alternatives. The proposed operating plan is shown in **Table 2.1-1**.

Vehicle Storage and Maintenance Facility

The 60-foot articulated buses proposed under the BRT alternatives are not compatible with lifts and other equipment used to service HRT's existing bus fleet, and HRT's existing maintenance facilities currently do not have the capacity to accommodate an increase in the number of vehicles. Therefore, a new vehicle storage and maintenance facility would be constructed as part of all BRT alternatives, including Alternatives 1A and 1B. Since the BRT vehicles can operate in mixed traffic, the VSMF does not need to be immediately adjacent to the guideway; however, a nearby site is desirable to minimize the amount of time the vehicles spend in non-revenue operations. For the purposes of this DEIS, the same site as the LRT VSMF has been identified for the BRT VSMF. **Figure 2.1-27** shows the conceptual layout of the BRT VSMF site.

The new BRT facility would become the headquarters for BRT operations. It would include administrative offices, operator lounges and meeting areas, and a control and dispatch center. In addition, the BRT VSMF would include storage areas for materials and equipment related to BRT operations and maintenance, such as road maintenance trucks, snow plows, and salt spreaders.

Figure 2.1-27 | Bus Rapid Transit Storage and Maintenance Facility (All Alternatives)



Source: HDR, 2014

Table 2.1-4A | Summary of BRT Alternatives

	ALTERNATIVE 1A: Newtown Road to Town Center	**ALTERNATIVE 1B:** Newtown Road to Rosemont	**ALTERNATIVE 2:** Newtown Road to Oceanfront via the NSRR ROW	**ALTERNATIVE 3:** Newtown Road to Oceanfront via Laskin Road
Length (miles)	**3.0**	**4.8**	**12.2**	**13.5**
Grade Separations (BRT over Street)	• Witchduck Road • Independence Boulevard (if Independence or Constitution Station Option is selected)	• Witchduck Road • Independence Boulevard	• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • London Bridge Road	• Witchduck Road • Independence Boulevard • Rosemont Road • Lynnhaven Parkway • First Colonial Road
Bridges over Water	• None	• Thalia Creek	• Thalia Creek • London Bridge Creek	• Thalia Creek • London Bridge Creek • Linkhorn Bay
Road Closures (Streets to be closed at BRT crossing)	• None	• Budding Avenue • Fir Avenue	• Budding Avenue • Fir Avenue	• Budding Avenue • Fir Avenue
Stations	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) — 3 site options	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) elevated options • Rosemont (with Park and Ride)	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) elevated options • Rosemont (with Park and Ride) • Lynnhaven (with Park and Ride) • North Oceana (with Park and Ride) • Convention Center • Oceanfront	• Newtown Road (existing Park and Ride) • Witchduck (with Park and Ride) • Town Center (with Park and Ride) elevated options • Rosemont (with Park and Ride) • Lynnhaven (with Park and Ride) • Great Neck (with Park and Ride) • Hilltop West • Hilltop East (with Park and Ride) • Birdneck (with Park and Ride) • Convention Center • Oceanfront

Source: HDR, 2014

Table 2.1-4B | Summary of BRT Alternatives

	ALTERNATIVE 1A: Newtown Road to Town Center	**ALTERNATIVE 1B:** Newtown Road to Rosemont	**ALTERNATIVE 2:** Newtown Road to Oceanfront via the NSRR ROW	**ALTERNATIVE 3:** Newtown Road to Oceanfront via Laskin Road
Length (miles)	**3.0**	**4.8**	**12.2**	**13.5**
Additional Vehicles	7 BRT Vehicles 12 Feeder Buses to Support BRT Service	7 BRT Vehicles 10 Feeder Buses to Support BRT Service	11 BRT Vehicles 11 Feeder Buses to Support BRT Service	12 BRT Vehicles 11 Feeder Buses to Support BRT Service
Storage and Maintenance Facility	Potters Road Site	Potters Road Site	Potters Road Site	Potters Road Site
Capital Cost				
• Current Year Dollars (2013)	Town Center West: **$227 M*** Independence/Market/Constitution: **$270 M*** ($27.7 M real estate already owned by City)	**$330 M*** ($34.5 M real estate already owned by City)	**$594 M*** ($58.1 M real estate already owned by City)	**$722 M*** ($55.4 M real estate already owned by City)
• Year of Expenditure (~2018)	Town Center West: **$264 M*** Independence/Market/Constitution: **$315 M*** ($30.5 M real estate already owned by City)	**$384 M*** ($37.3 M real estate already owned by City)	**$693 M*** ($61.2 M real estate already owned by City)	**$839 M*** ($59.3 M real estate already owned by City)
Operations and Maintenance (O&M) Costs				
• Estimated Cost to Operate and Maintain BRT Extension (2014 Dollars)	**$1.6 M** Local Share: $0.9 M	**$1.8 M** Local Share: $1.0 M	**$3.4 M** Local Share: $2.0 M	**$3.9 M** Local Share: $2.3 M
• Estimated Cost to Operate and Maintain Local Bus and Wave Services, including New Feeder Routes, in Virginia Beach (2014 Dollars)	**$18.6 M** Local Share: $7.1 M *(Increase of $3.1 M over FY 14 Budget)*	**$18.4 M** Local Share: $7.0 M *(Increase of $3.0 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*	**$20.4 M** Local Share: $7.8 M *(Increase of $3.8 M over FY 14 Budget)*
Ridership Forecast				
• Average Weekday Boardings (Forecast Year 2034)	**2,340 Total BRT** 1,440 BRT Stations in Virginia Beach 5,430 LRT Stations in Norfolk + 900 BRT Station in Norfolk **7,770 Total System**	**2,960 Total BRT** 1,980 BRT Stations in Virginia Beach 5,460 LRT Stations in Norfolk + 980 BRT Station in Norfolk **8,420 Total System**	**4,395 Total BRT** 3,365 BRT Stations in Virginia Beach 6,425 LRT Stations in Norfolk + 1,030 BRT Station in Norfolk **10,820 Total System**	**6,730 Total BRT** 5,690 BRT Stations in Virginia Beach 6,655 LRT Stations in Norfolk + 1,040 BRT Station in Norfolk **13,385 Total System**
• Annualized Ridership (Forecast Year 2034)	2,371,000	2,569,000	3,302,000	4,084,000
• Annualized Ridership w/ Visitor Boardings (2034)	2,473,000	2,671,000	3,642,000	4,424,000

Source: HDR, 2014

** Costs rounded to nearest $1 million.*

***Current Virginia Beach Bus Service = $10.5M in 2012 with a Local Share of $4.0M*

Norfolk System Costs = $ 34.5 M Total / $ 14.2 M Local Share (2012)

Norfolk Bus Costs = $ 22.8 M Total / $ 8.5 M Local Share (2012)

Norfolk LRT Costs = $ 11.7 M Total / $ 5.7 M Local Share (2012)

Capital Costs

Design and construction costs of the BRT build alternatives (escalated to the year 2018 as the mid-point of construction) are as shown in **Table 2.1-4B**. Additional detail on the cost estimates is attached in **Appendix H**.

Operations and Maintenance Costs

Operating and maintenance costs have been forecasted for each of the BRT alternatives using FTA-approved methodologies. These costs (in current year dollars) are shown in **Table 2.1-4B**.

Ridership Forecasts.

Ridership forecasts for the BRT alternative were developed using the same models and techniques described for the LRT alternatives. A detailed description of the ridership methodology is found in **Section 3.2**.

Ridership projections for the BRT alternatives are shown in **Table 2.1-4**.

Bus Feeder System

Since the station locations are the same for both the BRT and LRT alternative, the feeder bus system for the BRT alternative mimics that of the LRT alternative. **Table 2.1-2** shows the changes in the existing fixed route service plans related to the build alternatives.

2.2 No Build Alternative

The No Build alternative includes all highway and transit facilities and services of the existing transportation system, plus highway and transit improvements from the financially-constrained *2034 Long-Range Transportation Plan* (HRTPO, June 2012) and proposed short-range transit service and capital improvements. Regardless of whether or not a VBTES build alternative is implemented, the projects associated with the No Build alternative would be funded and implemented.

2.2.1 No Build Highway Improvements

Highway projects currently programmed in the *2034 Long-Range Transportation Plan* in the VBTES Project Corridor are identified on **Figure 2.2-1** and include the following. Only the Laskin Road improvement projects would have a significant effect on the VBTES corridor.

Fully Funded Committed Projects

A. I-264/Lynnhaven Parkway & London Bridge Road Improvements – The first phase consists of an eastbound I-264 off-ramp to London Bridge Road and a westbound I-264 on-ramp from London Bridge Road and was completed in 2012. The second phase consists of the design and construction plans for the improvements to the existing interchange at Lynnhaven Parkway and I-264. This phase is currently unfunded.

B., C. I-264 Concrete Replacement Project – This project will patch the deteriorated areas in the eastbound and westbound lanes on I-264 from Witchduck Road to Lynnhaven Parkway and Lynnhaven Parkway to Parks Avenue.

Regionally Funded Construction Projects

D. Lesner Bridge Replacement (E. Stratford Road to Page Avenue) – This project will replace a structurally deficient and functionally obsolete bridge.

E. Witchduck Road (I-264 to Virginia Beach Boulevard) – This project will widen Witchduck Road to a six-lane divided roadway with aesthetic improvements. Roadway modifications are also included at Admiral Wright Road and Denn Lane.

F. Laskin Road (Republic Road to Oriole Drive) – This project will widen Laskin Road to an eight-lane divided highway from Republic Road to Winwood Drive, including bike path and sidewalk, and a six-lane divided highway from Winwood Drive to South Oriole Drive. This project will also widen First Colonial Road from I-264 to Republic Road. This project is not currently funded in the six year plan. *(Note: On-going coordination is occurring between the VBTES and this VDOT-managed project.)*

G. Laskin Road (Oriole Drive to 30th/31st Street) – This project will include street and traffic improvements, such as a roundabout, streetscape improvements, and utility upgrades for Laskin Road from Oriole Drive to the Oceanfront Resort Area.

Locally Funded Regional Projects

H. First Colonial Road (Old Donation Parkway to Virginia Beach Boulevard) – widen from four lanes to six lanes.

I. Newtown Road (Baker Road to Virginia Beach Boulevard) – widen from four lanes to six lanes.

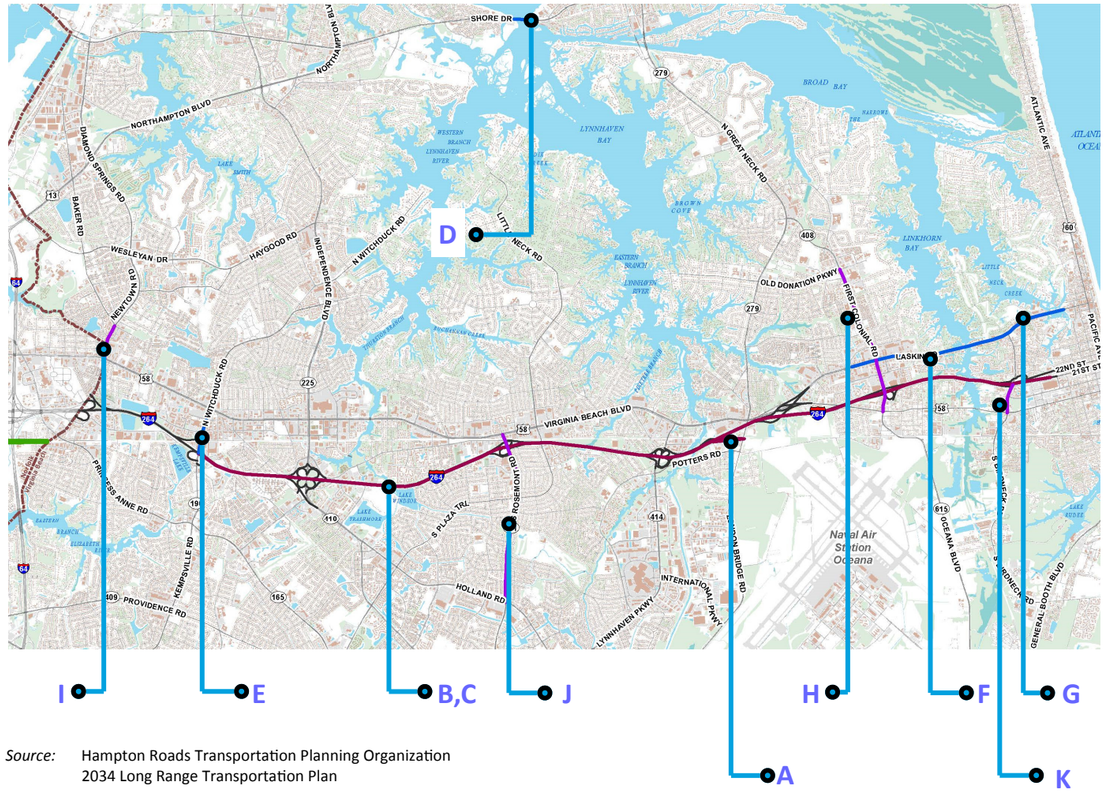
J. Rosemont Road (Virginia Beach Boulevard to Holland Road) – widen from four lanes to six lanes.

K. Birdneck Road (I-264 to Virginia Beach Boulevard) – widen from four lanes to six lanes.

2.2.2 No Build Transit Improvements

There are no significant transit improvements planned or programmed in the *2034 Long-Range Transportation Plan*. **Table 2.2-1** lists the existing bus routes in the VBTES Corridor that would continue to operate under the No Build alternative.

Figure 2.2-1 | No Build Alternative Roadway Improvements (See Text for Projects)



Source: Hampton Roads Transportation Planning Organization
2034 Long Range Transportation Plan

Table 2.2-1 | No Build Alternative Transit Service in VBTES Corridor

Route	Span of Service			Service Frequency			
	Weekday	Saturday	Sunday	Period	Weekday	Saturday	Sunday
Route 1	4:43 am - 1:17 am	4:39am - 1:29am	5:37am -1:31am	Peak	15	30	60
				Base	30	30	
				Late Night	60	60	
Route 20	4:54 am - 1:15 am	5:23 am - 1:17 am	6:23 am - 1:17 am	Peak	15	30	60
				Base	30	30	
				Late Night	60	60	
Route 22	6:03 am - 6:56 pm	6:03 am - 6:50 am	n/a		60	60	n/a
Route 25	6:02 am - 12:48 am	6:05 am - 12:48 am	n/a		60	60	n/a
Route 26	6:31 am - 6:45 pm	7:32 am - 6:46 pm	n/a		30	30	n/a
Route 27	5:48 am - 12:56 am	5:48 am - 1:03 am	n/a	Peak	30	60	n/a
				Base	30		
				Late Night	60		
Route 28	6:00 am - 6:51 pm	n/a	n/a		30	n/a	n/a
Route 29	6:48 am - 6:45 pm	6:48 am - 6:45 pm	n/a		60	60	n/a
VB Wave 30*	8:00 am - 2:00 am	8:00 am - 2:00 am	8:00 am - 2:00 am	Peak	5	15	15
				Base	15		
				Late Night	15		
VB Wave 31*	9:30 am - 11:10 pm	9:30 am - 11:10 pm	9:30 am - 11:10 pm		20	20	20
VB Wave 32*	10:00 am - 10:00 pm	10:00 am - 10:00 pm	10:00 am - 10:00 pm		60	60	60
Route 33	6:30 am - 7:43 pm	6:30 am - 7:43 pm	6:00 am - 7:15 pm		60	60	40
Route 36	5:48 am - 10:41 pm	6:10 am - 10:46 pm	n/a	Peak	30	60	n/a
				Base	60		
				Late Night	60		
Route 960 MAX	6:00 am - 8:55 pm	7:00 am - 8:50 pm	7:50 am - 8:50 pm		60	60	60

Source: HDR, 2013 ** VB Wave routes operate seasonally from May 1st through Labor Day weekend .*

Chapter 3 | Transportation

3.0 Transportation

This chapter summarizes the characteristics of the existing transportation system in the VBTES Corridor and discusses the potential impacts and mitigation associated with the build alternatives. This chapter consists of four sections: Streets and Highway Network (**Section 3.1**), Transit Network and Transit Facilities (**Section 3.2**), Parking Facilities (**Section 3.3**), and Bikeways and Pedestrian Facilities (**Section 3.4**).

3.1 Streets and Highway Network

This section describes the existing and potential future street and highway roadway operations in the VBTES Corridor. It identifies potential direct and indirect effects to those facilities from the implementation of the VBTES build alternatives, and it identifies potential mitigation measures for those effects. A more detailed discussion of the traffic analysis and results is provided in the *Traffic Operations Technical Report*, **Appendix J** of this DEIS.

3.1.1 Legal and Regulatory Context

Under Commonwealth of Virginia statutes, the City of Virginia Beach is responsible for the operation and maintenance of the streets within the City except the interstate highways. The Virginia Department of Transportation (VDOT) provides some funding for the maintenance of local roads; however, the majority of funds for operation, maintenance, and expansion of the city's streets comes from the City. VDOT operates and maintains the interstate highway system including I-264 and I-64 using a combination of state and federal funds.

3.1.2 Methodology

The traffic analysis methodology for the VBTES is summarized below.

Data Collection

Traffic operations data was obtained from the City of Virginia Beach, the Hampton Roads Transportation Planning Organization (HRTPO), and VDOT. Data gathered for this DEIS included recent traffic counts where available, travel demand model output, traffic signal timing data, and roadway geometric data. HRTPO's Transportation Improvement Plan (TIP) and the City's Capital Improvement Plan (CIP) were reviewed to determine locations of known planned and/or programmed (funded) transportation improvements within the VBTES Corridor.

Traffic counts in the VBTES Corridor were assembled from the City of Virginia Beach's Traffic Count Database System (TCDS). This database contains 24-hour traffic counts and intersection turning movement counts, usually data collected on a Tuesday, Wednesday, or Thursday, at various locations in the City. The counts are raw data and are unadjusted for seasonality or other variations. When counts were not available through the TCDS, weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection turning movement counts were collected in May and June of 2013. The counts were conducted on a clear day when area schools were in session.

In addition to morning and evening peak period intersection counts, 24-hour daily volume counts were collected for key roadways within the VBTES Corridor where TCDS data were unavailable.

Traffic Analysis Tools

The operational analysis for the study area intersections was completed using Synchro 8.0, a computer-based intersection operations model that replicates procedures from the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2000 and 2010). The program was used to assess both the current and future operation of intersections in the VBTES Corridor.

Analysis of potential grade separated crossings was performed using criteria identified in the Institute of Transportation Engineers (ITE) Light Rail Transit Grade Separation Guidelines report, dated March 1992. The ITE methodology considers operational, safety, institutional, and financial issues in evaluating whether a crossing should be grade separated. The proposed grade separated crossings are identified in **Chapter 2, Tables 2.1-3A and 2.1-4A**, and additional detail regarding the grade separation analysis can be found in **Appendix J.**

Performance Measures

The key performance measure analyzed in this DEIS is intersection level of service (LOS). LOS is a qualitative measure of how effectively an intersection processes traffic. In general terms, LOS is a function of vehicle delay through an intersection. Six levels of service are defined with letter designations from A to F, with LOS A representing the best operating conditions and LOS F representing the worst.

The City of Virginia Beach has identified LOS D as the minimum acceptable level of service for design purposes. For this analysis, intersections that operate or would operate in the forecast year below LOS D (LOS E and F) have been identified as below standard.

Level of service is determined differently for signalized and unsignalized (stop sign controlled) intersections. This is due primarily to driver expectations and behavior. For signalized intersections, LOS is a measure of driver discomfort and frustration and lost travel time for all movements through an intersection. For unsignalized intersections, delay is measured only for vehicles waiting to cross or turn from streets that have a stop sign onto a road where traffic moves freely. **Table 3.1-1** summarizes the LOS criteria.

Assumptions

The following assumptions were considered for this analysis:

- The traffic volumes and signal data collected in the City's 2009 traffic signal optimization study were assumed to represent 2013 conditions, as traffic in the VBTES Corridor has remained relatively constant due to recent economic conditions. At locations where traffic volumes were not available, traffic volumes were interpolated and distributed based on existing morning and afternoon peak hour travel patterns from the nearest study area intersection with available counts.
- The Hampton Roads Regional Travel Demand Model was used to derive the rate of growth for traffic between the current year (2013) and the forecast year (2034).
- Train control (for LRT alternatives) or bus control (for BRT alternatives) at currently signalized at-grade crossings would require automated crossing gates. These gates would pre-empt (alter) the normal red-yellow-green cycle of the intersection to give priority

Table 3.1-1 | Intersection Level of Service Criteria

	Description of Condition	Level of Service (LOS)	Intersection Control Delay	
			Signalized (seconds/vehicle)	Unsignalized (seconds/vehicle)
Delay meets standards	Few delays at intersection	A	0-10	0-10
	Slight level of delay	B	>10-20	> 10-15
	Fair level of delay	C	>20-35	>15-25
	Noticeable delay	D	>35-55	>25-35
Delay exceeds standards	Signal cycles frequently fail	E	>55-80	>35-50
	Over capacity	F	>80	>50

Source: 2000 Highway Capacity Manual (Special Report 209)